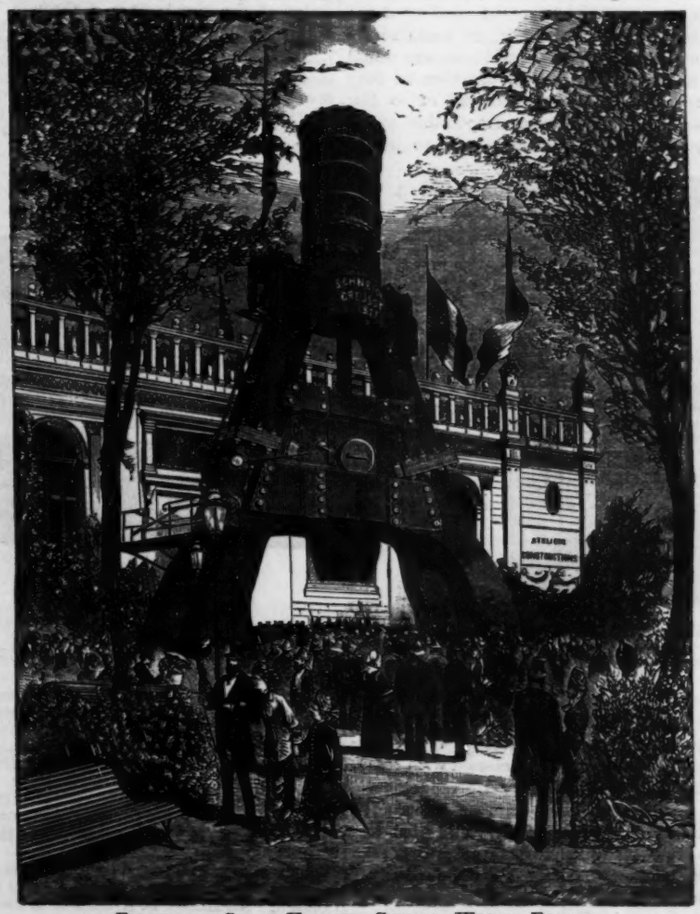
A NEW MECHANICAL DICTIONARY.

Since the completion of Knight's American Mechanical Dictionary, in 1877, the progress made in the development of the mechanical arts is unprecedented in the history of the world. Not only in such striking and wonderful achievements as relate to the telephone, phonograph and electric light, toward which popular attention is naturally drawn, but in every department of applied mechanics, there has been developed a fertility of resource in the adaptation of means to ends quite as marvelous and equally important in practical results. Achievement has outrun the most sanguine expectation, and with such rapidity that even the most recent records are found to be very deficient in supplying the special information most desired.

The hearty approval which Knight's American Mechanical Dictionary has received in all parts of the world has encouraged the publishers to issue an entirely new volume, thus continuing the record



EIGHTY-TON STEAM HAMMER, CREUSOT WORKS, FRANCE.
From Knight's American Mechanical Dictionary.

from the date at which the former work went to press, but carefully avoiding repetition, and aiming to furnish not only a satisfactory supplement to the original work, but a book which shall have an individual and separate value as a complete record of half a decade in the history of invention. From this fact it is evident that this volume forms an indispensable supplement to all works of reference upon mechanics now extant, as none of them cover the period mentioned.

The same method has been adopted in dealing with the subject matter in both works. First, each article appears in its proper alphabetical place, thus fulfilling the function of a dictionary, in affording direct response to inquiry. Second, the items of information thus distributed throughout the work are classified in special indexes of the art, profession, or manufacture to which they pertain. The book thus fulfills the function of a cyclopedia, which is a collection of treatises.

The value of a work of reference depends largely upon its index. When one has a question to ask of an ordinary cyclopedia it is frequently very difficult to determine under which title or heading to look.

The author has invented a system of what he terms "specific indexes," by the use of which the inquirer is guided straight to the information he is in quest of, even though he be entirely ignorant of the name of a thing, and have but the most vague and general notion of its use. This is accomplished by grouping under the general title of each science, art, trade or profession a list or "specific index" of every article in the book bearing any relation to the subject in question. The titles of these indexes are in turn grouped at the beginning of the book, so that by a glance one may determine which clew to follow.

Beside the use above mentioned, these specific indexes afford the reader an excellent opportunity for investigating thoroughly all that pertains directly or indirectly to any special subject, by using the index under the title of that subject as a sort of head-center, and following out its various branches through all their ramifications.

Special attention is called to a new and valuable feature in the work, by means of which exhaustive information on any subject is placed within easy reach. The author has made a complete index to technical literature, covering a period of five years, and embracing all English and American technical journals published from 1876 to 1880 inclusive. Under title of each subject may be found a complete list of every article which has appeared, during this period, in the columns of these periodicals, and as every subject of importance has been thoroughly discussed therein, it is evident that the whole range of recent investigation is thus placed at easy command. This index cannot fail to meet with the heartiest appreciation among those who have experienced the labor and difficulty attending an exhaustive search upon any line of inquiry.

"Index-learning turns no student pale,
Yet holds the eel of science by the tail."

The work treats of many thousand subjects, and is illustrated with over 2,500 carefully prepared engravings and numerous full-page plates, and for general typographical excellence, quality of paper and printing, it is unsurpassed. It may be bound uniform with any edition of the Knight's American Mechanical Dictionary, or with any cyclopædia or other book of reference of the usual size and shape. Sold only by subscription in four sections, containing 240 pages each.

For further particulars address the publishers, Houghton, Mifflin & Co., Boston, Mass.

PUBLIC IMPROVEMENTS AT MINNEAPOLIS.

For the purpose of learning something in regard to the progress of work upon a few of the public improvements proposed in Minneapolis, a reporter of the *Pioneer-Press* called yesterday morning upon Superintendent Johnson, of the Water-Works, and City Engineer Rinker for the desired facts in their respective departments, and in response to inquiries the following interesting information was courteously furnished.

NEW WATER MAINS.—Superintendent Johnson stated that among the new water mains just completed or approaching completion, and concerning which but little has been said in the papers, was one on University avenue, extending from Third to Thirteenth avenues southeast, a distance of ten full blocks. Another important main is being laid on Fifth avenue southeast, from Seventh to Division streets, so as to afford fire protection to the mills and manufactories which have recently sprung into existence upon and in the vicinity of the last-mentioned thoroughfare. A 12-in. pipe is also being laid on University avenue north, necessitating blasting through 5 ft. of limestone for a considerable portion of the distance covered by this branch of the water supply system. This pipe will be laid three full blocks, and was completed for two-thirds of the distance last evening. Numerous other connections will probably be made during the season under the direction of the Board of Water-Works Commissioners, but no data was obtainable showing the probable disbursements of the summer for the amount of the water mains and pipes.

AT THE PUMP HOUSE.—The new tunnel for the water-works has been completed, and a substantial retaining wall constructed for a distance of 250 ft. from the north end. Fair progress is being made in the construction of the new addition to the pump house, more commonly known as the "pump house extension," which is expected to add to the efficiency of the works in providing an ample and reliable supply of water at all times—the old pump house having failed to meet the demands of rapidly increasing population. Twelve thousand feet of new pipe are now being laid at the rate of one block per day.

CITY ENGINEER'S DEPARTMENT.—The department under the capable supervision of City Engineer Rinker is crowded with business just now—bridge building, street improvements, paving, sewers and various other important matters being intrusted almost exclusively to him. Owing to the manifold duties devolving upon him, he has been compelled to place one of his assistants, Mr. J. E. Snyder, in charge of the street work proper, and there are at present 30,000 cu. yds. of street excavation under contract, and fully as much more will be advertised for, which is twice as much in that particular direction as has ever been done in the city at any one time. During the summer between $40,000 and $50,000 will be expended in grading and clearing the streets of the city, under the most economical disbursements of the fund under his control.

SEWER WORK.—One of the most important duties intrusted to Mr. Rinker is the extension of the sewer system, on account of its direct effects upon the public health and convenience. Owing to the fact that all the bids for the sewer extensions thus far received have been exorbitantly high, the common council has authorized Mr. Rinker to employ men by the day in this branch of the service, and to reject all bids. Under the authority thus conferred the city engineer on Wednesday began operations on the Eleventh avenue south sewer, which will be two miles in length, extending from the Mississippi river up Eleventh avenue for some distance, and from thence to Hennepin avenue, the total cost of this one refuse carrier alone being estimated at about $80,000. Machinery will be utilized in the construction of the above and other sewers authorized by the council, and the total expenditure for extensions of the sewer system during the season will be from $150,000 to $175,000, but the large sum cannot be expended for a better purpose.

The above partial exhibit of the operations and disbursements of two of the public departments is sufficient to show the extent and cost of the improvements now commenced or authorized, but which are imperatively demanded to keep pace with the general advancement of the city of Minneapolis.—*Pioneer-Press*, June 17.

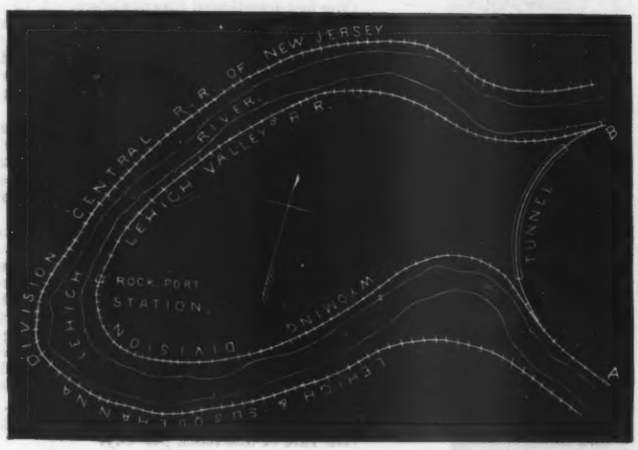
WAVER POWER.

La Nature, of Paris, gives an account of an apparatus, designed by M. Ganchez, for utilizing the force of waves, and consisting essentially of a float, weighing from 35 to 95 tons, which is connected with a bell-shaped compressor by ropes or chains passing over pulleys. The float is submerged and rises and falls with the waves. When it falls it raises the bell, which has previously been below the water level, and as it empties itself of water the air rushes into it through openings in the top. As the float rises again the bell sinks, the water rises in it and compresses the air, driving it out into pipes which conduct it to reservoirs on shore, whence it can be distributed as required.

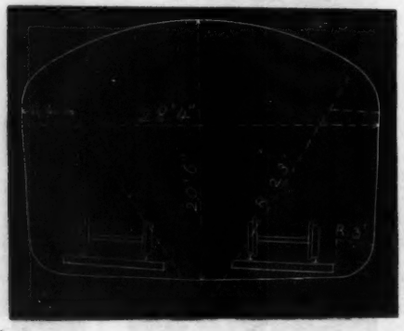
THE ROCKPORT TUNNEL.

The accompanying map (Fig. 1) shows the present location of the Lehigh Valley Railroad and of the proposed tunnel, for constructing which a contract has just been awarded to Mr. John Donoghen, of Emmittsburg, Md. The tunnel will be about 1,200 ft. long and will be excavated through rock the entire distance. The estimated amount of excavation in the tunnel is 22,000 cubic yards, and in the approaches 40,000 cubic yards of earth, 20,000 cubic yards of loose stone and 10,000 cubic yards of solid rock. Work will be commenced at an early day. Fig. 2 is a cross-section of the tunnel, which will be 20.5 ft. from bottom to top of arch and 28 ft. 4 in. wide at the spring points. The company will save by the tunnel 7,311 ft. of road and 333° 18′ of curvature in curves of from 2° to 11°.

The Superintendent and Chief Engineer is Mr. Robt. H. Sayre, whose headquarters is at Bethlehem, Pa.



MAP.



CROSS SECTION.

THE BROCKPORT TUNNEL.

Curvature: old line, A to B, 463.°06 ; new line, A to B, 129.°48 ; saved, A to B, 333.°18. Distance: old line, A to B, 9700 ft.; new line, A to B, 2389 ft.; saved, A to B, 7311 ft.

ABANDONMENT OF STEAM TRAMWAYS IN PARIS.—The Paris Tramway Company wished to give steam a thorough trial, and as they have had five years' experience of it, and have tried every system they could find—the number was no less than 21—they have every reason to consider that their acquaintance with the merits and defects of steam power is pretty exhaustive. The end has been that they have totally abandoned steam and reverted to the old system of employing horses. The result of the prolonged trials has been to show that steam is dearer than horse-power. The engine requires a driver and a stoker, whose pay is greater than two of the old drivers or coachmen. Then the fuel and maintenance of the engines in order were costly, while the original outlay in capital is about the same as that required to keep up the requisite stud of horses. Moreover, hardly a week, often a day in the week, passed without some accident on the steam line, which proved very costly to the company, and led to complaints being addressed from various quarters to the authorities. Hence, the authorities at last issued a prohibition against the employment of steam, and in this the company acquiesced with perfect readiness.

CORRESPONDENCE.

THE STANDARD WATER METER.

NEW YORK, June 15, 1882.

EDITOR ENGINEERING NEWS:

We take pleasure in acknowledging the merits of your editorial on water meters in ENGINEERING NEWS of June 10, 1882, and it has been our privilege to read your valuable paper the past two years, and particularly valuable on account of the full and elaborate "History and Statistics of American Water-Works." One of the reasons why water meters are not looked on with more favor is on account of there being so many put on the market without merit in themselves and which have brought ridicule on a necessity now felt over the entire country; for it is not a question of revenue to the water departments, nor of wastage, but yet a question more vital. Where is the water to come from if something is not done to prevent this increasing habit of waste? Were it not that the water meter business had not been used so much as a stock speculation and the real motive of the companies lost sight of (that is, to manufacture and sell water meters), every good company would have been benefited by the introduction of fifty good meters of different styles instead of so few representative ones, and every responsible meter company can but appreciate any work to purify the business and bring to the front real worth. While we are willing to accord to the Worthington, Union and Crown their places as representative meters, yet we claim to be classed with them, for we have met with good success introducing the Standard Water Meter into a number of cities in the country, and can show as many and good testimonials for merit and endurance as any of the others, and while we have no shop of our own at present we contract them out with one of the largest manufacturers in the country, who can verify our statements. You are doing a noble work to your fellows when you try to educate them to save what is generally considered worthless and what is so priceless.

Yours truly,

HENRY C. FOLGER, Sec'y.

THE HISTORY AND STATISTICS OF AMERICAN WATER-WORKS.

BY J. JAMES R. CROES, M. AM. SOC. C. E.

(*Continued from page* 199.)

CCCXXXVII.—STAUNTON.

Staunton, Virginia, in lat. 38° 10′ N., long. 79° 1′ W., is on an elevated plateau in the Blue Ridge, about 1,450 ft. above the sea level. The site slopes to N. E. and S. E. at the rate of about 25 ft. to the mile. Settled before 1738, it was incorporated as a city in 1871. Water-works were built by the city in 1875, after plans of Donald Allen, taking the supply from 10 springs issuing from the limestone rock. The water is collected by stoneware pipes of from 4 to 16-in. diameter laid in cement. About 2 miles of pipe are used. The collected water is pumped by a Worthington compound duplex engine, 176 ft. into a reservoir 210 ft. in diameter at top and 18 ft. deep, built in excavation and embankment, puddled and lined with gravel, with its surface 215 ft. above the city.

Distribution is by 5 miles of cast-iron pipes of from 12 to 3-in. diameter, with 32 fire hydrants, 35 gates and 5 meters. The number of taps is not known. Service pipes are of wrought iron.

The population in 1880 was 7,767, and the daily consumption 500,000 gallons.

The works have cost $100,000. The bonded debt is $80,000, at 8 per cent. interest. The expenses in 1881 were $4,000 and the receipts $9,000.

The works are under the control of the City Council.

E. W. Harman is the Superintendent.

CCCXXXVIII.—TRURO.

Truro, in Nova Scotia, in lat. 45° 30′ N., long. 63° 30′ W., at the mouth of Salmon River, near the head of Cobiquid Bay, is on level ground between Cobiquid Mountain and a hill which rises back of the town. Settled in 1760, it was incorporated as a city in 1875, in which year water-works were built by the town under the superintendence of W. H. Tremain, C. E. The supply for domestic use is taken from a small stream about 35 ft. above the town and 50 ft. above the pumps, which are placed so as to take a supply for fire purposes from the Salmon River. For the domestic supply the water of the brook, filtered through brush and gravel with not very satisfactory results, is conveyed directly into the mains. For fire service two rotary pumps driven by two 25 horse-power steam engines pump directly into the mains. The machinery was furnished by the Waterous Engine Works. Steam can be raised and fire pressure of 90 to 115 lbs. put on the mains in from 9 to 12 minutes' notice.

Distribution is by 4 miles of cast-iron pipe of 8 to 4-in. diameter, with 32 fire hydrants, 12 gates and 108 taps. Service pipes are mainly of wrought iron coated, and some lead pipe.

The population in 1880 was 4,000. The consumption is not known.

The works have cost $30,000, which is the amount of the bonded debt at 6 per cent. interest.

The expenses in 1881 were $900, and the receipts $500.

The works are managed by a committee consisting of the Mayor and three members of the Town Council. Alexander L. Archibald is the Engineer and Superintendent.

CCCXXXIX—COLUMBUS, MISS.

Columbus, Mississippi, in lat 33° 28′ N., long. 80° 25′ W., is on the Tombigbee River, on the east bank of which the ground is rolling, and on the west level. It was settled in 1819.

Water-works were built by the city in 1867, taking the supply from an artesian well of 4-in. bore which discharges 150,000 gallons per day, 10 ft. above the surface of the ground. The water is lifted 110 ft. by a Knowles pump into a brick reservoir 20 ft. in diameter and 25 ft. high.; whence it is distributed by 1¼ miles of 6-in. cast-iron pipe, with 18 fire-hydrants. The number of taps is not given. The population in 1880 was 5,350. The daily consumption varies from 10,000 gallons in winter to 50,000 gallons in summer.

The works have cost about $3,000. No further financial statements are given.

M. A. Hale is the Superintendent.

CCCXL.—SAN DIEGO.

San Diego, California, in lat. 32° 41′ N., long. 117° 13′ W., is on San Diego Bay. The surrounding country is hilly.

The site was first occupied in 1769 by a Jesuit Mission. The present city was founded in 1830, and incorporated in 1850.

Water-works were built by a private company

in 1873 after plans of H. M. Covert, taking the supply from the San Diego River, which drains 40 square miles, and pumping it 220 ft. by a Hooker steam pump of 8-in. bore and 42-in. stroke, into two reservoirs, one holding 100,000 gallons 100 ft. above the town, the other holding 850,000 gallons 200 ft. above the town.

Distribution is by 6 miles of 5-in. riveted wrought-ifon pipe, asphalted. The pipe is made of No. 14 sheet iron. There are 5 fire hydrants, 11 gates and 300 taps, and 51 meters. The town does not pay for use of hydrants. Service pipes are of wrought iron, coated.

The population in 1880 was 2,700. The daily consumption is 80,000 gallons.

The capital stock of the company is $350,000. The works have cost $79,000. There is no debt.

The expenses in 1881 were $14,828,08, and the receipts $17,975,57.

E. J. Buell is the Superintendent.

CCCXLI—SANTA BARBARA.

Santa Barbara, California, in lat. 34° 26′ N., long. 119° 43′ W., is at the southeast end of a valley 2 miles wide and 5 miles long between a range of hills along the Pacific coast and the Santa Inez range of mountains. Missouri Creek, a stream of ten square miles water-shed, in which the water runs only during the rainy season, passes through the city.

Settled by the Jesuit missionaries about 1780, it was incorporated as a city in 1874.

A reservoir was constructed by the Franciscan monks about 50 years ago, by a stone dam laid in cement, across Mission Creek, 100 ft. long, 16 ft. thick and 16 ft. high, with both sides vertical. From this basin the water was conveyed 10,000 ft. by an open conduit lined with stone and cemented, to a reservoir 110 ft. square and 10 ft. deep. The walls of cemented stone are vertical on the inner face, 15 ft. thick for 4 ft. from the bottom and 3 ft. thick at top. Its surface is 300 ft. above the city.

In 1873 the conduit being much obstructed by breaks from land slides and growth of roots, a wooden flume, V-shaped, with sides 12 in. wide, and laid on a grade of 2½ ft. per 100, was substituted, and distributing pipes were laid in the city, after plans of Hermann Schuessler, C. E., and under the superintendence of R. B. & A. W. Canfield. The pipes were of No. 16 wrought iron, with riveted joints, and coated with asphalt and coal tar. In the business part of the town, where the pressure at night frequently was over 90 lbs., the riveted pipe leaked greatly and has been replaced by cast-iron pipe. There are 4¼ miles of pipe, of from 6 to 2-in. diameter. The 6-in. and 5-in. are of wrought iron, riveted, the 4-in. of cast iron and the 3-in. and some 4-in. of wrought iron, welded. There are 14 fire hydrants, 19 gates and 220 taps. Service pipes are of iron, some galvanized and some coated with asphalt and tar.

The population in 1880 was 3,600, and the daily consumption 180,000 gallons.

The works are owned by a private company, with a capital stock of $120,000. They have cost $30,586, besides $20,000 paid for the old works. The gross receipts to December, 1881, have been $55,548.20. There is no debt. Further financial statements are not furnished. R. B. Canfield is the President, and A. W. Canfield the Secretary and Superintendent.

CCCXLII.—LANCASTER, O.

Lancaster, Ohio, in lat. 39° 42′ N., long. 83° 35′ W., is on the Hock Hocking River. The ground rises from the river and the Hocking canal to a hill 263 ft. above the canal.

Settled in 1800 and then called New Lancaster, the prefix was dropped in 1805.

Water-works were built by the city in 1877, after plans of A. Bauman. The first works were for fire protection only and consisted of a small pumping engine and a single line of pipe, taking water from the Hocking canal. In 1878 a stand-pipe 18 ft. in diameter and 69 ft. high was erected. In 1880 the boiler proving too small, steam was brought 200 ft. to the engine from an iron works. Permanent works were then built. A well 20 ft. in diameter and 18 ft. deep, sunk in water-bearing gravel, receives the water from a gallery 270 ft. long, which is built of brick, is 4 ft. wide and 4½ ft. high, arched at top and taking its water from the bottom. It is to be made 500 ft. long. The water now rises to the surface of the ground and wastes over the top of the well.

A Worthington pumping engine with 20-in. steam and 12-in. water cylinder of 15 in. stroke, lifts the water 133 ft. into the stand-pipe which is on ground 64 ft. above the pump.

The construction of a reservoir on Pleasant Hill, 263 ft. above the city is contemplated.

Distribution is by 6 miles of cast-iron pipe of from 12 to 4-in. diameter, with 61 fire hydrants, 25 gates and 100 taps. Service pipes are of lead.

The population in 1880 was 8,000. The daily consumption is not known.

The works have cost $46,801.46 to March 20, 1882, for construction, and $2,397.60 for operating.

The bonded debt is $25,000.

The expenses in 1881 were $1,854.38, and the receipts, $1,196.55.

The works are managed by three Trustees. A. Bauman is the Secretary and Superintendent.

CCCXLIII—MALDEN.

Malden, Massachusetts, in lat. 42° 25′ N., long. 71° 3′ W., on Malden River, a stream tributary to the Mystic River, is on level ground in the southerly part of the town and hilly to the northward. It was settled in 1634.

Water-works were built for the town in 1870 by G. H. Norman after plans of A. F. Sargent, C. E., taking the supply from Spot Pond, which also supplies Medford and Melrose. It has a water-shed of about 2 square miles and an area of 296 acres at 139 ft. above tide water. The supply is by gravity.

The distribution is by 36.8 miles of wrought-iron and cement pipe, of from 16 to 4-in. diameter, with 198 fire hydrants, 317 gates and 2,468 taps. There are 29 meters in use. The town pays $3,000 per annum for public hydrants and drinking fountains. Lead service pipes are used.

The distributing pipes are made by the water board, which is found to cost about 25 per cent. less and to insure better pipe than purchasing from manufacturers. Prior to 1875 considerable trouble was had with the freezing of pipes. In that year more than a mile of main was frozen at one time and thawed out by use of steam. Since then pipes have been laid deeper. The population in 1880 was 12,017, and the daily consumption 480,000 gallons.

The cost of the works has been as follows, to December 31, 1881: For construction, $362,101.53; for maintenance, $69,513.49; for interest, $198,092.79. The receipts have been $290,883.09. The bonded debt is $350,000, at 6 per cent. The expenses in 1881 were: For extensions, $6,792.05; for maintenance, $4,325.66, and for interest, $21,000. The receipts were $34,301.11.

The works are managed by three commissioners, one being elected each year. W. W. Hawkes is the Superintendent.

(TO BE CONTINUED.)

The receipt of statistics, as follows, is acknowledged with thanks: From W. W. Hawkes, Superintendent, statistics and water-works of Malden, Mass., and full set of reports from 1873 to 1881. From A. Bauman, Secretary, statistics and report of the water-works of Lancaster, O. From R. B. Canfield, President Mission Water Co., statistics and water rates of the water-works of Santa Barbara, Cal. From E. J. Buell, Secretary and Superintendent, statistics and water rates of the water-works of San Diego, Cal. From Alexander L. Archibald, Engineer, report and statistics and water rates of the water-works of Truro, Nova Scotia. From M. A. Hale, statistics of the water-works of Columbus, Miss. From E. W. Harman, Superintendent, reports, statistics and water rates of the water-works of Staunton, Va.

BAR OF RIO GRANDE.

From *The Rio News* of Rio de Janeiro, Brazil, we clip the following:

For many years past there has been considerable conflict of opinion as to the cause of the bar at the entrance to the port of Rio Grande. The prevailing idea, however, has hitherto been that the silt and alluvial matter brought down by the water from the interior was deposited at the entrance of the estuary and formed the bar. This notion has been so elaborated that calculations have been put forward of the actual quantity in cubic meters of sand which have been thus deposited. But a careful examination of what actually takes place during the prevalence of north-east and east winds clearly shows that this supposed deposit from the upland waters does not now take place to any appreciable extent, and hence is insufficient to account for the present state of the bar.

Another theory for the formation of the bar is that it results from the meeting of the fresh water and the northeast swell. The concussion produced is presumed to cause the suspended earthy matter to fall to the bottom. A third theory is that the action of the southwest swell has been such as to drive the sand towards the entrance and thus cut off the scouring action of the outflowing current.

It is possible that a combination of these influences has considerably increased the tendency to forms and banks at or near the present bar, but close observation shows that its present state is entirely due to the breaking of the ocean waves on the shallow bottom. During the prevalence of the east and northeast winds the sand-banks are surrounded by a heavy surf. Every broken wave tears up sand from the bottom. This sand is carried forward by the water, and is eventually deposited by the total dispersion of the wave. The sand thus deposited forms in course of time a shoal on which in turn more waves break, and it assumes under their action a ridge with deeper water on either side. Now this action, under which the bar was in a state of continuous though possibly very slow growth, would not be prevented by any increase of velocity or scouring action of the outflowing current. It is true that in favorable seasons and strong gales from the west and northwest some counter action would be set up, and the outflowing current would remove a part of the recent deposit; but the first gale from the east and northeast would re-establish the conditions and the ridge would be reformed higher and broader than before. That this is the case at the bar of Rio Grande is demonstrated beyond question by the experience of the last ten months.

The only remedy for this action of the ocean wave is by dividing this belt of surf and compelling it to break at a distance from the entrance to the navigable channel; or, in other words, to construct some artificial obstruction so as to prevent the waves of translation from acting upon the bar, when the sand now forming it is removed either by dredging or any other mechanical agency. But it must be borne in mind that no amount of dredging applied in the present state of the bar can be of the slightest avail, because the conditions necessary to secure success do not exist. It must also be distinctly understood that a breakwater will not remove the present bar, but it will prevent the formation of another when the present one is removed, and it will enable the outflowing current to keep the navigable channel open by facilitating the scour into deep water.

It is believed that the great error which has hitherto been committed in dealing with the harbor of Rio Grande has been the constant interference with the bed of the estuary inside the bar, while no attention was paid to the formation of the bar itself. Dredging has been carried on at intervals inside the entrance and this has formed so many holes or hollows by which the declivity of the channel has been altered and the uniform scouring action of the outflowing currents interfered with if not partially destroyed, for it is obvious that all scouring action must be due to the lower stratum of water and not to the surface currents. Soundings recently taken show that the bed of the present channel is higher at its entrance from the sea than at the anchorage opposite Sao José do Norte, clearly proving the cause of the retardation of the scour. All observations tend to confirm the opinion that any permanent and effective improvement to the harbor must commence outside the entrance.

The grand obstacle to these improvements, and more especially the construction of breakwaters, is the probable expense. The estimate presented by Sir John Hawkshaw in 1875 put the cost of efficient, permanent breakwaters for the improvements at Rio Grande at £2,000,000 sterling. If such an outlay were absolutely necessary, then it is questionable if such works are possible; but on the other hand it may be asked if it is not practicable to construct an efficient breakwater at a much less cost. The experience of other similar works shows that breakwaters have been erected in very exposed situations which have proved effective, the costs of which were scarcely a sixth of that stated by Sir John Hawkshaw. At Rio Grande the absence of all suitable material in the shape of stone, shingle, etc., precludes the idea of having recourse to the modern system of concrete blocks, or large masses of stone; but the province to the north of Porto Alegere would furnish an abundant supply of excellent timber as well as any quantity of rubble stone. With these a breakwater could be constructed which would insure immediate means for improving the entrance to the harbor.

The use of timber may be objected to as not being sufficiently durable, but if an effective breakwater could be constructed to last say 50 years, it is to be expected that long before that time the immense advantages which would accrue to the port, would furnish ample resources to maintain such a structure or on the same site gradually to construct one of more durable material. The urgency of the case is such that any means should be resorted to that would insure a speedy removal of the present obstructions; and objections on the score of durability should not weigh against the certain ruin of the trade of Rio Grande, if not of the whole of the south of the province, by delay.

It is confidently believed that with an expenditure of £300,000 the necessary works could be carried out, including the eastern breakwater and the removal of the present bar by a special system of dredging, and that a permanent channel could be opened for vessels drawing 12 ft. 6 in. at all seasons of the year.

Designs have been prepared for a breakwater combining some novel features in the adaptation of piled structures to sandy bottoms. But before presenting these plans to the authorities, the author of them suggests that they should be submitted to the best authorities on harbor engineering for revision, so as to avoid as far as possible the expenditure of money upon mere empirical schemes.

ENGINEERING NEWS

AND

AMERICAN CONTRACT JOURNAL.

Tribune Building, New York City.

GEO. H. FROST.....EDITOR AND PROPRIETOR.

S. D. V. BURR.....ASSOCIATE EDITOR.

SATURDAY, JUNE 24, 1882.

EDITORIAL ANNOUNCEMENTS.

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Articles for Publication in the current number should be received at the office of publication not later than Thursday morning, and advertisements not later than Friday noon.

Correspondence upon subjects which naturally belongs to the province of this journal is solicited.

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THE Federation of Contractors, of Belgium, held a meeting on May 24. A resolution was passed authorizing the publication of a journal to be entitled *La Construction*, organ of the Federation, to be under the management of M. Andre Hertogs, President of the Federation. Also that the officers of the Federation be charged with representing it officially in relations with the Government and public departments. Also that lectures be arranged on subjects interesting to those engaged in the building trades.

"TREATISE ON CEMENT," compiled and arranged by M. Albert Schull, is the name of a neat little twelve-page pamphlet "presented" by the Lawrence Cement Co., 67 William street, N. Y., and designed especially to specify the excellences of "Hoffman" Rosendale cement, manufactured by this company. In the few pages are collected numerous valuable hints upon cement, its use, etc., gathered from personal knowledge, and very largely as is duly acknowledged, from the published works of Gen. Q. A. Gillmore and D. H. Mahan, but which, filling small space and being easily looked over, are convenient and will repay the outlay of the postal card necessary to obtain it.

THE PROPOSED SAHARAN SEA.—The French Minister of Foreign Affairs, M. de Freycinet, has recommended a special commission for the investigation of the above project. M. Roudaire's scheme—the one under consideration—is to excavate a canal nearly 150 miles long, 32½ ft. deep below the sea-level, and 328 ft. wide, to lead the waters of the Mediterranean from the Gulf of Gabes into the empty lake beds known as the *chotts* of Rharsa and Mebrir. The Minister does not consider the expense prohibitory. In favor of the scheme is urged the improvement of the climate in the lake region, the fertilized soil, the barrier against the incursions of nomad tribes, the improvement of the commerce of Algeria and Tunis with the interior, and the formation of a harbor of refuge for French mercantile marine in case of war. The objections are the great evaporation causing excessive saltness of the water, and that the water will stagnate and become pestilential. M. Roudaire, however, thinks that a return current to the Mediterranean might be established at the bottom of the canal, and M. de Lesseps thinks the saltiness will decrease. The Commission, the appointment of which has given much satisfaction, is to inquire into: first, the practical means of forming such a lake; second, the probable consequences of doing so, physical, political, and commercial; third, probable expense, and terms on which the work might be conceded to a private company.

BOSTON ENGINEERING IMPROVEMENTS.

A few weeks ago we were just on the point of starting by rail for a New England city, when a friend suggested going with him by way of Boston. As Boston is always a very agreeable city to visit, the suggestion was accepted, and at the regular hour we left New York by the famous Bristol, of the Fall River Line. It was the evening after Decoration Day and the boat was crowded, fully four hundred unprovided with staterooms sleeping on the floors or sitting on the lounges all night, and the ventilation of the main saloon was so bad that by nine o'clock, while the noisy band was tooting its loudest notes, the air was as stifling and foul as that of an emigrant steamship steerage. In the outer state rooms the air was fresh and pure. The steamboat route is usually a popular one, but why, one can hardly realize after using it. It is as expensive as by rail, it is more tedious, and necessitates the getting from the boat to the cars at a most aggravatingly early hour in the morning, so that the traveler arrives in Boston in a very tired-out condition to commence the day upon. By the railway one leaves New York at 4:30 p. m., and for $5.75 he is landed in Boston in time to go to bed a little after eleven and get well rested for next day's business. We have made the trip by boat several times, but for comfort of body and purse we think the all-rail route superior to any other.

The Boston hotels are all good, and it is but a question of convenience which to go to. We have got into a habit of going to Young's, because it is immediately adjacent to the City Hall and in the very center of business. It has been a hotel for gentlemen only until recently, a very large addition has been made to it, and it may be considered now a leading Boston hotel. It is on the European plan.

In the offices of the City Engineer and City Surveyor we never noticed so large a force of employés as on this visit. Possibly on account of the rainy day fewer men were engaged in field work, but upon inquiry we found that both departments were very busy with the work on hand. City Engineer Wightman and his talented First Assistant, A. Fteley, were very busy in discussing with numerous aldermanic and others visitors various engineering schemes, but mostly relating to the city water supply, while Assistant Engineer Brackett was "up to his eyes" in meter experiments. By the way, understand that the paper prepared by Messrs. A. Fteley and F. P. Stearns, of the Boston City Engineer's office, entitled, *Description of Some Experiments on the Flow of Water, Made During the Construction of Works for Conveying the Water of Sudbury River to Boston*, and which was read only by title at the Washington Convention, contains some entirely new and very interesting facts in regard to the flow of water, which will give it a prominent place in the literature of the subject as soon as it is printed in the Transactions of the American Society.

The park system of Boston is taking shape with satisfactory rapidity. From the Common, situated in the center of the city, one passes through the Public Gardens and up the broad Commonwealth Avenue into the new and extensive Park, reclaimed from the lowlands, and now being transformed into a beautiful pleasure ground by the genius of the landscape gardener and architect. When this is completed, Boston, with its beautiful park-like suburbs in addition to this chain of public parks, may well be proud of them as distinctive features in its attractions.

At work on an immense *wooden* sewer contract in the new park, we witnessed the working of Carson's excavating machinery. Simple, cheap and effective, it handled the excavated material most admirably, taking it in huge buckets from the section in process of excavation, and dumping it directly on the completed sewer in the section following. The excavation was over twenty feet deep, but there were no stops, no throwing up of material by gangs of shovelers to blockade a whole roadway, and to be thrown back when the work was advanced to it. It was all done at once with few men, a minimum of labor, and no fuss. We afterwards saw the same apparatus working in a narrow Boston street without interruption to travel alongside, and in a still more difficult location, laying a sewer in a railway freight yard, without interrupting the passage of the constantly running trains in either direction. It is truly one of the most effective and labor and money-saving engineering appliances that has been offered to contractors for a long time. The city of Boston has bought the right to use it in its city work, and we understand that Mr. Carson, who is in the service of the city, is meeting with great success in introducing it to contractors in other cities.

The improved sewerage works at Dorchester and Moon Island are steadily progressing. The big Leavitt engines are up, housed in with a temporary structure and ready to be set in motion. A large weir has been constructed for testing purposes, and it was intended to commence pumping the sewage into the bay opposite South Boston. But the people of that district got out an injunction, and as it will be two or three years more before the tunnel and the Moon Island works are finished, so will the large investments in machinery already made lie idle for that length of time. The work already completed is very great and the magnitude of the whole scheme can only be realized by personal inspection. With Mr. Wm. Jackson, Assistant Engineer in Charge, we visited the works at Dorchester, and thence going by steam launch to Moon Island saw what was being done there. Half way across is the central tunnel shaft around which a considerable island has been built with the excavated rock. The work, originally let to B. Malone, is now being done by the city, under the superintendence of Malone, Jr., the elder Malone being engaged on a railway contract in Pennsylvania.

The Moon Island contract is being done by J. A. Sylvester and associates. They have a large force of men, two locomotives and a long train of dump cars, besides a steam excavator, busy at work. We met Mr. Sylvester as we were returning, and very naturally inquired about his success with his tide breaker, which we have already illustrated, and which is advertised elsewhere. We learned from him that his tide breakers have been used for the past two years with great success in Piscataqua River, N, H., in removing "Gangway Rock," where the tide flows with a velocity of seven miles per hour; and it need hardly be said that contractors will see its utility when the fact is considered that rock which would have cost to remove without the breakers at least $1.25 per cu. yd., actually cost only 28 cents per cu. yd., and it is said that the United States government would have saved thousands of dollars

by the use of one or more tide breakers in Hell Gate for deepening the channel, had this invention been made a few years ago. Contractors contemplating the construction of bridge piers and abutments, or the removal of obstructions in swift currents, will find it to their advantage to investigate the claims made for this invention.

On the suburban trains of the Boston & Albany Railroad is an automatic contrivance for closing the doors of the coaches without the usual slamming. It consists of a small cylinder attached to the top rail of the inside of the door; an arm at one end attached to the car beside the door, has a piston working in the cylinder attached to its other end. When the door is opened this piston compresses the air, the door is allowed to close of itself, which it does gently, surely and leisurely, after the manner of all other good Boston institutions. The relief to one's nerves to be rid of the everlasting slam-banging of coach doors is peculiarly grateful.

THE RAILROAD AND INDUSTRIAL OUTLOOK.

Within two or three weeks several large contracts which were withdrawn from the market last January have been presented to manufacturers and accepted at prices very little different from those presented at that time. Contractors and builders report a perceptible improvement in business, not very marked perhaps, but sufficient under the circumstances to strengthen our hope that the worst has been passed. It is better that the iron and general industrial interests should have endured at this time a six months' check than that production should have galloped ahead at last autumn's limits without regard to diminishing requirements. It is not correct to assert that we are on the eve of a revival, but it is correct to say that greater confidence exists in the future commercial and industrial activity than six months ago. At that time it was estimated there were projected in the United States alone 17,800 miles of road; of that mileage some 3,600 are reported built, leaving 14,200 of projected mileage, a considerable portion of which is made up of parts of unfinished lines. The foreign demand for American railway bonds is again improving. Railway prosperity depends to a great extent on the whims of European capital, which for the past few months has been averse to liberal investment. The present improvement in demand is based on the increasing volume of staple products which American producers of wealth can offer in exchange for foreign values. The failure to maintain that volume of exchangeable products led to the restriction in railway activity and to the train of effects dependent on this cause.

Some of this 14,200 stretch of mileage is to be pushed to completion that the finished property may be in a condition to earn some dividends. The manufacturers of rails report a greater readiness to go ahead in railway construction than a few months ago. The railroad antagonisms have been virtually settled, and unfavorable and restrictive and directive railway legislation has been set aside, it is quite safe to say permanently. The trunk lines are looking for transcontinental connections, and combinations of the leading officials of several have very recently visited the far West to promote railroad interests. Immigration is developing Western resources, vast possibilities are being opened up in the far Northwest and the far Southwest.

The agricultural productive capacity is being very rapidly increased, and the new regions now penetrated with trunk and main lines only will soon require lateral connections and branches.

Those who imagine we have reached a stopping place in railroad building are not familiar with the rapidly expanding requirements for traffic and travel on both sides of the Mississippi.

Europe has cheap labor, but America has cheap land, and herein lies the secret of the approaching international struggle for trade which will impart fresh life to railroad building.

It is probable that the labor strikes will be adjusted in a few weeks. Manufacturing interests were taken by surprise at the inauguration of a strike on such an enormous scale. Even now the general trade does not admit the probability of a prolonged period of idleness. Stocks of iron and steel are low in hands of manufacturers and jobbers. The steel manufacturers were obliged to concede the workmen's terms. The iron manufacturers will stubbornly resist, not only the advance in wages, but the authority exercised. The formation of an association for the purpose has been effected on a basis and with a degree of unanimity which presages a stubborn conflict on their part. Over one hundred rolling-mills are idle, with over two thousand furnaces. It is calculated that enough mills are at work to meet pressing requirements of consumers and free manufacturers from the necessity of concession.

The threatened scarcity, however, has drawn out a great many buyers, who have been holding back for the lower prices which increasing capacity seemed to secure. Crude iron, of course, shows a downward tendency, all other kinds an upward tendency, except perhaps, rails, which are steady and firm. Bridge, plate, tank, bar and sheet iron are all in fair demand, but there is nothing of a booming tendency anywhere. The trade prefers low and regular prices, and in spite of strikes, the course of prices is downward as capacity expands.

PHILADELPHIA SEWERS.

The recent political reform movement in Philadelphia seems to be extending also to engineering matters, which, from all accounts, are sadly in need of improvement. On Monday an ordinance was passed by the city councils directing the chief engineer hereafter to build all sewers having less sectional area than a circle 4 ft. diameter, *egg-shaped*. Heretofore all sewers, of whatever size and for whatever purpose, were built circular. It is astonishing that to this day egg-shaped sewers have been under a ban in Philadelphia, while almost all other cities have long ago fully conceived their advantage. But what is more astonishing is the fact that city councils must pass an ordinance to this effect. We have been under the impression that the *shape* of a sewer is a matter belonging to science; that it varies with the duty the sewer has to perform; that it should be adapted to each particular case, and that it is the province of the city engineer to determine it. But we seem to have been mistaken. The Philadelphia council have "ordained" that all small sewers shall be egg-shaped. It is therefore not allowable, for instance, to lay down any circular pipe sewers, as the *smallest* public sewers built in Philadelphia have been 3 ft. in diameter. This point, however, did not occur to the authorities.

We are glad to see that the sewerage of our neighbors is to be improved by the City Fathers passing this ordinance, although it contains this objectionable feature. It is far better than to persist still longer in the ancient method of building large circular sewers to drain a single house. But we regret to see that the profession of city engineering is to be bound by other laws than those of science and economy in determining the best designs for public works, and hope that the example will not be followed elsewhere.

KNOXVILLE (TENN.) WATER-WORKS.

At a meeting of the Aldermen of Knoxville on the evening of the 16th inst. the bid of the Knoxville Water Co. for the erection and maintenance of water-werks of that city was accepted after considerable discussion by a vote of 9 to 6. The only other bidders were the "Knoxville City Water Co." and Messrs. J. A. Cloud & Co., 18 Wall street, New York. The present water-works are to be built upon the "Moses Lane" plan of 1879, or not as specified by the City Council, and whether on that plan or on the plan and specifications submitted by the contracting company the works and machinery are to be equal in capacity and quality to those designed by "Moses Lane, Hydraulic Engineer." The reservoir is to have a capacity of 3,200,000 gallons; there will be 75 hydrants; 2,000,000 gallons will be supplied every 24 hours; private persons are to have water at 5 cents per 100 gallons; work to be commenced within 30 days from signing contract, and to be complete within 12 months thereafter; company to lay its pipe, etc., and maintain the works in good condition for 30 years or until purchased by the city; failure to commence work or to complete as above subjects the contract to forfeiture; the company may issue only $125,000 in the next five years and thereafter only $25,000 additional; the company to erect telegraphic fire alarm; the city to grant right of way, etc., and to pay as the annual rental for 75 hydrants the sum of $50 each; payments to be made quarterly, on the last day of each quarter; also to exempt the property of the company from municipal taxation for the period of five years from Jan. 1, 1883; the city may purchase at the end of 15 years upon assessment; the company shall not assign the contract for the construction of water-works, but may mortgage its property or subject portions of the work of construction.

By the proposed contract the city is not required to spend a single cent of money or to assume a single liability.

PHILADELPHIA CITY ENGINEERING.

(CIRCULAR.)

737 WALNUT STREET, MAY 24, 1882.

To The Members of the Committee on Surveys:

On Thursday, the 18th instant, I presented an ordinance directing that hereafter all sewers shall be built of an oval or egg shape—it was referred to your Committee.

The advantage of what is called the "egg-shaped" sewer is shown in the following sketch [which exhibits comparative diagrams of circular or egg-shaped sewer sections not necessary to be reproduced for the benefit of *our* readers.—ED. ENGINEERING NEWS.]

The same amount of water gives a greater depth of channel in the "egg-shaped" sewer than in the circular or round sewer, and consequently carries the sewage away quicker and cleaner.

This kind of sewer is in use in all the great cities abroad, is used in many cities in America, and is recommended by the best scientific skill.

I also at the same meeting of Councils presented an ordinance requesting and authorizing George E. Waring, of Newport, Rhode Island, upon such compensation as may be determined, to examine the sewerage system of Philadelphia, and report such suggestions for alterations and permanent improvements as he deemed wise and expedient. This was also referred to your Committee.

It is unnecessary for me to say anything in support of Mr. Waring's position as a sanitary engineer. His system for Memphis, after a year's experience, is referred to by William Henry Baldwin, in Vol. 3, page 270, of the Proceedings of the Engineers' Club of Philadelphia. His report on the New York City sewerage is found in Scribner's Monthly Magazine for May and June, 1881.

He has reported upon the sewerage systems in Baltimore, Norfolk and other cities. His suggestions would certainly be of use to the city.

There is nothing before Councils that the people are more interested in than the proper protection of their homes from sewerage gas, and a clean, healthy system of drainage, both house and sewer. Everything should be done that human skill and man's ingenuity can devise.

If Councils appropriate $100,000 from any surplus fund for main sewers, or hereafter make any appropriation for the same purpose, it would be well to have all the scientific information we can obtain, so that the work done in this city in the future will be to its credit and to the healthful benefit of its people. DALLAS SANDERS.

What sort of a town is Philadelphia, anyhow! It has recently re-elected its present City Engineer for the third term; it commissioned a very competent Sanitary Engineer, upon the recommendation of its City Engineer and in co-operation with the National Board of Health, to proceed to Europe to investigate the best methods of sewerage in use there, and it has been acknowledged by such authority as Mr. Chesbrough that the report prepared by Mr. Hering on the sewerage of Philadelphia is the ablest document on that subject that has been published for many years, and that it shows a most thorough and comprehensive knowledge of the peculiar needs of Philadelphia. That report, accompanied with a set of most admirably executed detail drawings, are now in the City Engineer's of-

fice. And yet, with all that has been reported for years upon the subject of Philadelphia sewers, it remains for *a lawyer*—not the City Engineer—to present to the Councils of the second city in the Union the above ridiculous circular, explaining the difference between egg-shaped and circular sewers, and telling the wise men that "this kind of sewer is in use, etc.," and also inviting Mr. Waring to come in and tell them what to do, on the strength of his Memphis sewerage and his popular magazine articles on New York shortcomings and his plan of helping them out. Mr. Waring now confidently asserts that Philadelphia will adopt his "separate" system and that he will "get his royalty." And he ought to get it if he has the genius and ability to enlighten and convert the apparently *very* ignorant, helpless and don't believe in-home-talent city government, that has devised the most skillful process of evasion of responsibility in all its departments that exists on this continent. It is however, really the "Philadelphia plan" to have a lawyer or a doctor devise its engineering, which is something after the style of the good-natured man who didn't care if his intended wife was slovenly, "he could get a clean hired girl."

Now that City Engineer Smedley and his chums in Councils have been enlightened on the existence and desirability of "egg-shaped" sewers, would it not be well to call in an apothecary's clerk, or a preacher, or some other intelligent Philadelphian to suggest a plan for a bridge or culvert, and possibly some other unemployed genius might be called in to help Dr. McFadden and the Water Department in the design of stand pipes and the cost of brickwork. Meanwhile civil engineers are notified that there is no hope for them among the Quakers.

NEW PUMPING ENGINE, BROOKLYN.

In accordance with previous advertisement and specifications in ENGINEERING NEWS of the following proposals were received for fourth engine and pumps: George W. Whittaker, one beam and fly wheel pumping engine, 15,000,000 gallons capacity, to be placed in present engine-house, no new boilers, change in building or well proposed in bid. cost $89,500. A. J. L. Loretz, two double-acting condensing beam engines, 15,000,000 gallons aggregate capacity, separate building, new well excavation, etc., no new boilers or chimney proposed, cost $159,341. Clapp & Jones, two pair of beams and fly-wheel engines, 15,000,000 gallons aggregate capacity, to be placed in the present building, new boilers and chimney, no price named for chimney, etc., cost $93,000. H. R. Worthington & Co., one pumping engine, 15,000,000 gallons capacity, new battery of boilers, separate building, new chimney, etc., for engine and boilers, $79.000; for building and excavation, $33,000, cost $112,000; also two pumping engines 7,500,000 gallons capacity each; new battery of boilers, separate building, new chimney, etc.; for engines and boilers, $84,000; for building and excavation $33,000; cost $117,000. M. T. Davidson & Co., four pumping engines, 15,000,000 gallons aggregate capacity, new battery of boilers, separate buildings, well, chimney, excavation, etc., engine to be duplex or separate; for engines and boilers, $70,000; for building and excavation, $38,000; cost, $108,000. Holly Manufacturing Company, duplex pumping engine, 15,000,000 gallons capacity; new buildings, new boilers, chimney, etc., without excavation; for engine and boilers, $86,800; for buildings and chimney, without excavation, $29,228; cost, $116,028; for single building and chimney, without excavation, $25,843; cost, $112.643. The cost of excavation would be about $4,500. William Golding, pumping engine and boilers, $125,000; no bid or plans for building or foundations.

Proposal of M. T. Davidson was accepted, and the following will be the cost complete:

Engines and boilers	$70,000
Building, foundations, chimney, well, etc	38,000
Force main, 36-in. diam, 3,600 ft	50,000
Engineering, inspection, changes due to new buildings, etc	12,000
Contingencies	7,000
Total	$177,500

ENGINEERS AND ENGINEERING IN OTHER LANDS.

[Specially translated and prepared from our Exchanges.]

Engineers are beginning, or rather continuing, to show themselves patriotic. In the race for trade, the best and safest harbors, the most extended river communication and several similar advantages will constitute important factors. At the meeting of the French civil engineers a long paper was read by M. de Coene on the importance of deepening the Seine. An example of what may be done is seen in the tonnage of the Port of Rouen, which had, in 1880, 1,500,000 tons, as against 400,000 before the river was deepened by longitudinal dikes. The large steamers of the present day will require even deeper water, and all the French ports will have to be greatly improved. A new dike to cost 25,000,000 francs is advocated.

Up to the present, as is known, all the cables of suspended bridges are composed of metallic wires, parallel and tightened at certain distances by wire ties. The tension of these wires is, however, very unequal. A. M. Arnodin proposes to make cables in the same way as ropes by twisting. It would seem that such cables are from 10 to 11 per cent. stronger than those having rectilinear thread. Oxidation, too, cannot do as much harm.

A letter from Panama to a gentleman in this city gives a few details about men and things there. The letter is dated from Buhio Soldado and says: "I do not believe that much complaint can be made about the workmen here, and all the revolver stories that I heard about before my departure from France are pure invention. I would recommend all coming rather to provide themselves with a very large sun umbrella than with a revolver. The food given out to us is very good. The train which passes near our house twice a day leaves meat, bread and rice. A fowl costs from 1 franc 50c. to 5 francs; eggs are 17 centimes a piece; milk 75 centimes per liter. The use of alcoholic drinks in this climate is very dangerous.

CONSTRUCTION OF BRIDGE PIERS WITH METALLIC TUBES.

This system is applicable to bridges not over 40 yards in length, and has great advantage over buildings in masonry, in point of economy.

As seen in cut, pipes of from 0.50 meters to 1 meter in diameter are used, and these are terminated by pile shoes of a conical shape. Stakes of this kind are sunk in the required position, and then bound by beams and braces, so as to form a solid whole, and one offering great resistance. This resistance may be calculated from the following formula used for wooden stakes in a sandy soil:

$$P = 80\,W + 0.228\left(\sqrt{F-1}\right)$$

W representing the weight of the pile driver in tons, and F the height of fall calculated in English feet.

The formula shows that the resistance offered by the pile increases proportionately to the weight of the pile driver, and to the square root of the height of fall of the latter.

The cut represents the simplest system where a pier formed of two uprights inclined to ¼ are joined by horizontal braces and inclined bars, and on the summit of which is the flooring of a bridge of 30 meters span. Each upright is composed of a pile-pipe *A*, the top of which is at low water level, and this is surmounted by another pile *B*.

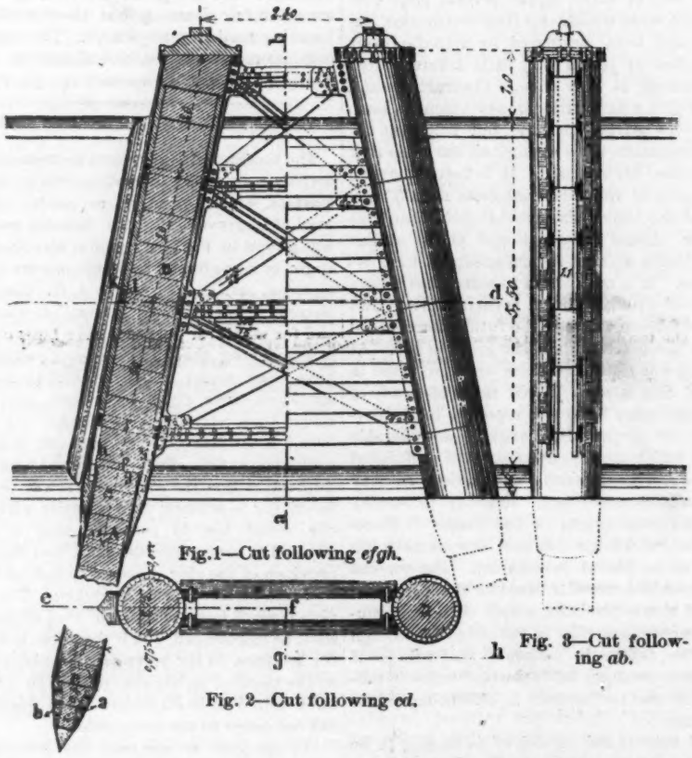

Fig. 1—Cut following *efgh*.

Fig. 3—Cut following *ab*.

Fig. 2—Cut following *cd*.

The pipe *A* is of boiler-plates, and riveted so as to be water tight; it ends in a conical surface *a*, to which a ring in cast steel *b* has been riveted. In the lower part of this ring, the cone of cast steel *c* fits in, and forms the pile shoe. The monkey of a weight of 5 tons strikes a sheet of cast steel *e*, which bears both on the shoe and the upper and inside surface of the steel ring *b*. The pipe *A* is then filled with a column of cut stone, and a metal plate *f* placed on it so as to distribute the weight equally on the pile. Immediately under this plate, the ring in cast iron *g* is fitted in. It is furnished with a rim having 10 notches, into which an equal number of keys *g* are hammered, and this arrangement has the effect of transmitting the strains from the pipe-pier to the pipe-pile.

This latter *B* is terminated inside in the shape of a truncated cone, surrounding the tube *A*, and serves during the hammering of the latter as a coffer-dam for keeping back high water. As may be seen, the pipe-pier *B* does not rest directly on the pile *A*, but on the upper plate *i*. The weight of the flooring is, therefore, thrown on the filling column in cut stone, which transmits it to the

pile *A*. The piers are sunk as follows: the pipe *A* being placed in the requisite position, the pipe *B* is fastened on to the head. The two tubes are brought together temporarily by the gibs *h*, then the pile driving is kept up until the tube *A* has sunk to the necessary depth.

The fifth general meeting of the German Architects' and Engineers' Union will take place in Hanover, from Aug. 20 to 24. It is thought that some 7,000 members will be present. Some very interesting questions, from an engineering and economic point of view, will be discussed—among them the improvement of water courses, with reference to agriculture; the best methods of deciding public contracts; conditions for delivering iron.

The discussion about the best system of sewers for Paris is not yet satisfactorily settled. Whether to send *everything* or *nothing* to the sewer is the explicit French phrase. In either case the present system of pits must be done away with. If the entire quantity of slops must go into the sewers, there must be an abundant supply of water to flood the pipes. The amount of infectious matter now being distributed from the Paris sewers is stated to be very great. Of 1,000 openings examined, a current of bad air from the sewer into the street was detected in 500 cases. The question whether typhoid fever is not a direct effect of sending fœcal matters into the sewer is also attracting attention. Mr. Waring's works on sewers in America were brought to the attention of the French Société Hygiène at their last meeting by Dr. Pietra-Santa. The questions of incline and of tides are very important in considering the matter, and, in both respects, Paris is at great disadvantage. Experiments are now making in the district between the barrack of La Pepinière and an experimental place at Levallois-Perret.

Prof. Steiner lately exhibited before the Austrian Engineers' Society a new instrument for measuring the tension of bridge works. It is the invention of Prof. Fraenkel, of Dresden, and shows the elongation or shortening of the fibers of such parts as it is fastened on. The diagram is made automatically. Such measurements as have already been made with it show a close similarity in the change of elasticity between the calculated and the observed. The instrument is to be improved, however, by having an optical device, instead of the instrument of precision consisting of a lever.

One of the great engineering works of the "late past" is nearly completed. The course of the Rhine has been changed and corrected on that portion of it, which lies along Baden, Switzerland and Alsace. Yet there can be little navigation from Strasbourg to Basle, and it is for this reason that the German Government contemplates the cutting of a canal from Ludwigshafen to Strasbourg. The first estimate is placed some $8,500,000. The sand banks are the great obstacle to Rhine navigation, and it is thought that these improvements will, in the course of years, remove them. The deposits of the Alsatian side move along that bank; but those of the Baden bank are carried along the opposite side. The works were begun in 1842 by the French and Baden governments. The plans of the Baden engineers were accepted in preference to those of the French, who wished to preserve the natural course of the river. In former years the French and German engineers seem to have simply thrown the current from one bank to the other alternately. It is rather singular that the works, which were estimated to cost 114 million of francs in 1840, the expense has been some 15 millions less. There is less infiltration along the new bank, and the intermittent fevers which had raged for centuries have disappeared. The Rhine flows calmly along in its new bed, but great works will yet be necessary before the river can be made what it should be. Its mysterious dwindling away as it approaches Holland may yet be prevented, but how to prevent such great percolation to subterranean depths is a problem the engineers have not yet solved.

The last issue of *The Ironmonger* has the following statement in regard to engineering in Russia: Complete stagnation prevails at all the engineering works in Russia. Various statements are in circulation in regard to the alleged decision of the Emperor to revive the Black Sea fleet at an outlay of 10,000,000 roubles. If Russia decides on establishing an iron-clad fleet in the Black Sea she will have to first extend the existing Southern dockyards, which will mean the purchase of a large amount of machinery in England. When this is accomplished she will become a buyer of a larger amount of coal, and will obtain most of the iron and steel from England for the vessels to be constructed. It is said that the dockyard will be removed from Nicolaieff to Sebastopol, in which case the purchases of new machinery will be of a very extensive character. There is also a talk of establishing an auxiliary dockyard at Batoum.

PERSONAL.

MR. E. P. PLEASANTS is chief engineer of the Baltimore & Delta Railroad.

MR. F. S. WALLACE is Chief Engineer of the Marietta & North Feorgia (N. G.) Railroad, with headquarters for the present at Jasper, Ga.

MR. ALBERT J. TWIGGS has resigned the position of superintendent of the Augusta & Knoxville Railroad in order to take the contract for grading the Savannah Valley Railroad from Dorn's mine to Anderson.

MR. CABELL BRECKENRIDGE, chief engineer of the Chattanooga & Vicksburg Division of the Cincinnati, New Orleans & Texas Pacific, in stepping from his private car at Vicksburg recently, fell and dislocated his ankle. He was conveyed by special train to his home in Tuscaloosa.

MR. A. B. ATWATER, AssistantT raffic Superintendent of the Port Dover & Lake Huron division of the Grand Trunk, and formerly Assistant Engineer on the Lake Shore & Michigan Southern and the Canada Southern railways, has been appointed Chief Engineer, vice J. C. James, resigned, of the Chicago & Grand Trunk Railway.

ENGINEER OFFICERS PROMOTED.—The promotions of First Lieutenants Richard L. Hoxie, William L. Marshall and Joseph H. Willard, Corps of Engineers, U. S. A., to be captains, to date June 15, are under section 9 of the act of March 3, 1853, which promotes to that grade, though without increasing thereby the number of officers allowed in the corps, all officers who have served fourteen years continuously as lieutenant. The promotions of Lieutenants Albert H. Payson and John G. D. Knight to captain are to fill vacancies created by the deaths of Colonel Twining and Major Howell.

THE WATERPHONE.

This instrument for detecting the waste of water, the invention of Assistant Superintendent Bell, of the Cincinnati Water-Works, according to the reports in the daily journals of that city, has been performing most efficient service. Mr. A. G. Moore, Superintendent and Engineer of the works, reports to the Board of Public Works as follows:

We have given the device of Mr. Bell a thorough and practical test, and find it to be a meritorious invention, and an invaluable instrument for water-works purposes.

It is void of complication in construction, simple in adaptation, inexpensive in application and most effective in results—a mere drip being distinguishable.

There have been ten different tours of inspection, consisting each time, with one exception, of only one gang of two men. Two hundred and sixty leaks and abuses have been discovered.

The nature of the wastes have been found to be due proportionally about as follows:

20 per cent. to designed abuses in water-closets.

60 per cent. to carelessness in leaky taps and connections, and failure to close stops.

20 per cent. to underground leaks.

The extent of these wastes may be better understood by the following table, in which the discharge of a ⅝-in. lead pipe 70 ft. in length for 24 hours under the several pressures is given, as well as the cost of water figured at meter rates of 12 cents per 1,000 gallons:

Pressure.	Discharge.	Gallons.
10 lbs	9,000 gallons	$1.14
20 "	13,700 "	1.64
30 "	15,700 "	1.88
40 "	17,700 "	2.12
60 "	24,000 "	2.88
80 "	28 800 "	3.45
100 "	31,700 "	3 80
120 "	34,500 "	4.14

The large increase in plumber's reports of repairs to water connections on file in this office shows the effect of the work already accomplished, and that the water consumers are beginning to understand the necessity of prompt attention to the correction of leaky faucets, etc., for they do not know how soon the Water-Works Inspector may call on them unawares.

The use of this instrument is undeniably of great utility in determining the improper conditions and uses of the service branches, and as Mr. Bell has to this time permitted a gratuitous use of them with fine practical and financial results, the permanent right to use same should now be secured.

SYSTEMS OF SEWERAGE.

We are favored with advanced sheets of the July number of the *Sanitarian*, published in this city, and from a comprehensive article in it entitled "The City Needs a Change of Air," by Dr. Richard McSherry, of Baltimore, Professor of Principles and Practice of Medicine, University of Maryland, we quote briefly:

Dr. McSherry's paper is highly interesting, and though intended for the latitude of Baltimore mainly, which in some respects is peculiar, yet the principles advocated will find application in all of our large cities, and he points out with much force, how a "change of air," which many are seeking at this season of the year, by a change of habitat, may be secured as well by a little attention to small matters of great sanitary value, not requiring an exodus from our homes in order to render effective. From the paper by Dr. McSherry, space will not permit more than the following brief reference to the vaunted "system" pursued in Memphis, and the present results, together with Dr. Bell's clear definitions of a proper system of sewerage.

Dr. Bell, it will be remembered, has for many years devoted his attention to matters of sanitary progress and the dissemination of the principles of hygiene, and the *Sanitarian*, now in its tenth year, edited by him, deservedly takes rank as among the most valuable of our monthlies.

"Baltimore is to be congratulated," says the *Sanitary Engineer*, "on having an engineer of the skill and experience of Mr. Latrobe to carry out a work that is at this time somewhat of a pioneer movement in its application to cities of its size and characteristics."

Is it not strange that there should be any *pioneering* in sewerage at this time of sanitary engineering? The rule is that the pioneers in this work have rarely had more than partial success, while in not a few instances their failures have been most signal.

With some sanitary changes not difficult of accomplishment, Baltimore can afford to wait until some system is proved by time and use to be fully worthy of adoption.

In most of our cities the sewerage is notoriously defective, notwithstanding the money and skill expended upon them.

Memphis now claims the greatest success in sewerage. A few years ago that city was in a frightful sanitary condition, and the result was disastrous epidemics of yellow fever in the years 1878-9. The city appeared to be doomed. But the people, with one accord, determined to rescue it from destruction. They went to work so earnestly in sanitary improvement, by a general cleansing, repairing of streets, emptying the foulest of foul sinks, and principally by a great system of sewerage under the directions of Col. Waring, that in a year, under the general renovation accomplished, they held a civic jubilee, a redemption day, a sort of sanitary Declaration of Independence, on the 22d day of September, 1880.

Full success was well merited, but was only partially obtained. In looking over the returns in the *Sanitarian*, and the bulletins of the National Board of Health, we find Memphis to be still amongst the most unhealthy cities in America. I offer the fact without comment, and certainly without asserting anything more than that the system of sewerage has not so redeemed it as might have been hoped and expected.

An editorial in a recent number of the *Medical News*, in treating of the "Lesson of Memphis," uses the following language: "The system of sewerage has been introduced, but it does not discharge into the Mississippi; it has been turned into Wolf River, a few hundred yards below the waterworks. The bayous have not only not been kept free from filth, but the sewers have been allowed to overflow into them. Only such sub-soil drainage has been introduced as was immediately con-

nected with the sewers laid—an amount altogether insufficient, as Dr. Maury remarks, to secure good drainage; and the source of the water-supply has not only been changed, but fresh sources of impurity have been brought to it by the sewers. It is not to be wondered at that the mortality has rather increased than diminished; that the deaths from dysentery have doubled, and that the death-rate from consumption is higher than on the bleak New England coast; on the contrary, it is rather surprising that the mortality has not been greater."

In a private letter from Dr. A. N. Bell to myself, this eminent scientist remarks: "A system of sewerage, in the sense of being some special plan or contrivance by which some patent or device is worked into a system, is the bane of all good sewerage; and in this consists the chief defect of the sewerage of Memphis." The Field tanks so extensively used were not only unnecessary to a city with such facilities for any desired gradient as Memphis or Baltimore, but, as compared with a limited amount of waste or roof water for flushing, are absolute defects and useless expense. A *good* system of sewerage is that which is adapted to the locality; it may be in part combined and part separate, and there may be also in part necessity for flush tanks, and the literature of the subject shows that engineers who are competent to comprehend and combine these several conditions are the only ones whose work approaches perfect satisfaction."

THE OPENING OF THE ST. GOTHARD TUNNEL.

MILAN, May 22, 1882.

Italy, Germany, Switzerland, and we may say all Europe, have participated with thorough satisfaction in the ceremonies attendent on the opening of the St. Gothard Tunnel; but, as is usually the case, the promoter, the initiator, of that great international work has been almost entirely forgotten in his birthplace, Milan, as in his beloved Lugano, where he spent the last twenty years of his life, in study and poverty, dying there in 1869. Carlo Cattaneo, the greatest philosopher and political economist of modern Italy, the guide and inspirer of the Five Days of Milan in 1848, when the unarmed citizens defeated and drove out from their city the entire Austrian army under Radetsky, as early as 1859 insisted on the tunnel through the St. Gothard, in the interests of Italy and Switzerland alike. We have even now before us his letter to the Genoese, showing to them "that the new current of commerce coming from Suez, it behooved them to prepare to take advantage thereof." After passing in review the various projects for the Splügen and other passes, he continued:

"St. Gothard is not only a predestined railroad, it is a map of railroads which unite and open out for themselves a common center; it is the military center of Switzerland, the fortress of liberty. The safety of those Alps is our safety; the pre-Alpine line from Brescia, from Bergamo, from Lecco acquires fresh and practical value from the union of the plains of Erba with Como. The two cities of Como and of Lecco gain other advantages; the railroad from Varese must be extended to the Lake of Como, the railroad from the Lake of Garda be led up to Orta. All the industries of the higher valleys connected, commerce will be doubled by the completion of the Simplon and Mont Cenis railroads. Fortunate Genoa, which in this heritage of nature has the lion's share, such is the free interval from Constance to Basle, with almost the entire valley of the Po and of the Rhine, together with the long list of industrial cities, Zürich, Strassburg, Mannheim, Frankfort, Coblentz, Cologne, Elberfeld, Amsterdam, Rotterdam, Liége, Brussels, Antwerp, Ostend. The natural port of the Valley of the Rhine on the Mediterranean is Genoa. Genoa and Hamburg will be the two ports on which the Swiss will think when they think of their own homes."

Cattaneo then went on to show how the line of the St. Gothard offered to Genoa the shortest line of communication, surpassing in this respect, for the special commerce of Italy, the Lukmanier, the Simplon, the Cenis, or the Brenner, and, as regards foreign commerce, uniting Genoa with the above-mentioned cities by a much shorter line than they could be with Marseilles; how, in a word, as soon as the St. Gothard Railroad should be completed, Genoa could take into her own hands the commerce of the German Rhine with the East in the place of Marseilles. His counsels, eagerly listened to by the Genoese, were enthusiastically accepted by the Swiss, but it was not until April, 1869, that a regular project was presented to the Swiss Federal Council, to the Italian Government, and to the Confederation of Northern Germany for the perforation of the St. Gothard.

The St. Gothard, until the present century, had been one of the least frequented passes, although the hospital of the monks of St. Gothard was founded in 1331. In 1816, however, a regular post between five Swiss cantons and Milan was established, yet up to 1820 the path was only practicable for horses and pedestrians, and until lately the journey from Lucerne to Turin occupied twenty-five hours and a half, whereas the same journey henceforward will occupy but eight hours. The convention for the construction of this railroad was signed by Italy and Switzerland in 1869, and in 1870 the North German Confederation adhered to the Convention. Engineer Gelpke and the geometrician Koppe were the chief designers. At first seven companies sent in their estimates—one Swiss, one Franco-Swiss, one Italian, one German, two English, one American. Finally L. Favre of Geneva, and the Italian Society of Public Works in Turin, headed by Grattoni, the constructor of the tunnel through Mont Cenis, were the only competitors, and to Favre the contract was assigned, his offer being considered the most advantageous. Meanwhile, the administration of the St. Gothard railway had arranged for the commencement of the excavations of the grand tunnel, begun in June, 1872. For the perforation the waters of the Reuss were utilized on the northern slope, those of Val Tremola on the southern. In 1879, Favre, who directed all the works in person, died suddenly of apoplexy in the tunnel as he was explaining the operations to some foreign visitors; nor was he the only victim, 179 workmen having lost their lives by accidents or suffocation, while hundreds of others have contracted maladies which sooner or later will bring them to the grave. One special form of anæmia, caused, it is said, by the insect *Anchylostomum duodenale*, has proved and is proving most fatal; indeed, a special hospital and convalescent home is being constructed for the survivors. The work, which was never interrupted, day or night, occupied nine years and three months—3,330 days in all. The first estimates of the sum total to be expended amounted to 227 millions of francs, of which Italy agreed to pay 55 millions, while various municipalities and provinces made up another 15 millions; Germany and Switzerland contributed 63 millions, the remainder of the sum being made up by shares, of which a vast number are held by Italians, so that in fact Italy has contributed far more than half of the sum total, the province and city of Milan alone furnishing two millions and a half.

The gallery of the St. Gothard runs in a straight line from the village of Göschenen to Albinengo, a village to the west of Airolo. The tunnel to be excavated along this line was 14,912 meters long, 2,700 meters longer than the gallery of Mount Cenis. In order to join it with the railroad which comes toward Airolo in an east-to-west direction, another gallery of 150 meters was excavated. The altitude at the entrance of the tunnel at Göschenen is 1,109 meters above the sea level; in the center 50 meters higher, at Airolo 40 meters higher. The geological formation differs essentially from that of the Cottian Alps. The bore of the gallery, after some 2,000 metres of granite or granite-gneiss, entered into crystalline schist, intersected with veins of serpentine, a mass, in short, of the hardest rock, which at first threatened to baffle the perforating machines. The hydraulic works were also extremely tedious, owing to the difficulty of obtaining a sufficiently strong body of water from the Reuss, while, on the Airolo side, during the winter, avalanches often obstructed the bed of the Tremola, rendering it necessary to excavate a bed under the snow. Signor Favre, in order to overcome the difficulty with the Reuss, constructed an enormous reservoir and a canal, while to baffle the avalanches he caused the water to be conducted by means of a wooden canal into the bed of a minor torrent, the Chiesso, less subject to avalanches. Other difficulties were encountered and overcome by his indomitable will, so that at his death it may be said that only the mechanical portion of the work remained. This was completed really in December, 1881, but the inauguration was delayed until yesterday, owing to various circumstances.

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It remains now to be seen whether Genoa will have sufficient skill and enterprise to profit by this enormous boon. It will not suffice that she is the nearest port to the great commercial cities of Germany and Switzeralnd. She must render her port and harbor safe and commodious as is Marseilles, her ship dues as low, her porters less insolent and exorbitant in their charges, or else the great French seaport will continue to outrival her as heretofore.—*N. Y. Nation.*

HARLEM RIVER BRIDGE.

The West Side & Yonkers Railway, New York, is a corporation that was formed for extending the elevated railway system on the west side of New York City over the Harlem River, to connect with the surface roads in Westchester County, particularly the New York City & Northern Railroad (once the New York, Boston & Montreal Railroad). This connection is about a mile long, commencing at the end of Eighth avenue, the terminus of the Metropolitan Elevated line, and ending at High Bridge, the commencement of the New York City & Northern Railroad, above noted. The principal engineering feature of the work is the bridge over the Harlem River and its approaches. In view of the contemplated improvements of the Harlem River by the General Government, the restrictions thereby created involved: 1st, a rectangular crossing with the contemplated bulkhead lines; 2d, a draw-span admitting of not less than 120 ft. uninterrupted water way either side of the pivot pier; 3d, masonry to be founded with reference to a future 18-ft. channel at low water. The above restriction of location involved the approach work on a curve at either end of 450 ft. radius. The whole work is for double track and proportioned on a somewhat lighter basis than is usual for first-class American bridges, since it can never be subjected to heavy freight engines or freight traffic. The river bridge consists of a central draw-span 300 ft. long and a deck-span of 100 ft. at either end, provided with foot-walks on either side in view of contemplated streets along the proposed bulkhead lines laid out for the river improvement. The above is all pin-connection work, and is supported on granite piers. The approach work on either side consists of riveted lattice and plate girders, the lattice work being so designed as to make the center lines of the web members intersect in the center lines of the chords. The riveting was more carefully performed than is usual in American work of that character, the holes all being punched small, and reamed out when parts were assembled to receive the rivets. The piers for the approach work are Belleville brownstone coped with granite. These piers were placed radially to the curves of approach, and were located and instrumentally maintained by a system of triangulation and intersecting lines. No direct measurements were made for any of the piers, and the whole has been a model of careful field work performed under the immediate direction of Mr. C. L. Cooke, Principal Assistant Engineer in charge of the work. The foundations across the river and on the New York side are in piles, and on the Westchester side, the start from the alluvial drift. They were all obtained by means of coffer dams, excepting the pivot pier, which was founded by means of a caisson with movable sides. The mode of coffer-damming was by driving a single row of tongue and grooved 6-in. planking with a pile-driver, bracing internally as the water was lowered and excavations made. At the site of the bridge, the Harlem River bed consists of a plastic mud varying from 6 ft. to 20 ft. in depth, overlaying a deposit of sand from 5 ft. to 15 ft. in thickness, under which is found a stiff clay running out to a knife edge on the Westchester side, where the alluvial drift is immediately below the sand. The 18-ft. channel involved piercing through the mud into the sand, and the above device for coffer-damming answering an admirable purpose, against a head of, at times, 23 ft. of water. Frequently the sand in the bottom gave a great deal of trouble, boiling springs breaking through and frequently carrying a stream of sand from under the toes of the sheet piling plank. Ordinarily an 8-in. pump would hold the bottom until piled, but one foundation was exceedingly troublesome, requiring a 12-in., an 8-in., a 6-in. and a 4-in. pump to hold the bottom until piled and concreted. The granite employed in the river bridge was in two colors, dark and light, the latter being used for coping, weathering and band courses, which was all bush-hammered work, and the former rock faced for the body of the piers. The red sandstone approach piers are all rock faced, which contrasts handsomely with the light granite coping. The draw-span is the portion of the superstructure of more special interest, it being up to date the largest double-track draw in the world, and is rather novel in general design and details. It was computed on the theory of no end reaction whatever from the dead load, when closed and loaded on one or both arms, the usual assumption now made in America for continuous draw-bridges. There being an ambiguity at best, in proportioning such bridges, a single system of web arrangement was adopted in panel lengths of 17 ft. 4 in., the diagonals towards the center being in sets of four. The truss is 20 ft. deep at ends, and 40 ft. deep at the center. There are two trusses 26 ft. apart centers, with sidewalks cantilevered out from suspended cross girders. The turn-table is a rim-bearing table solely, made with extreme care, machine faced and turned in all moving parts. While the truss delivers its load to four central posts, the bearing table is so arranged as to divide on eight symmetrical points on the drum, thus distributing the whole weight over all the wheels. The machinery for operating the draw is all within the table, and consists of a double (5 in. × 7 in.) cylinder oscillating engine, with shafting and friction clutches. The free ends of the draw are supported on cams, connected with the levers of which are a system of toggle joints and levers for raising the rails clear and free from the permanent work, the whole being operated

from the central engine by line shafting beneath the floor. The mechanical attachments are such that, with the first movement of the capstan wheel which connects the engine with friction clutches, raises the rails, following which the cams are drawn, when the span hangs free. The second motion of the capstan throws the table shafting into gear and the bridge swings. An indicator in front of the operator always shows the exact position of the bridge and defines its centering position. The turn-table is also provided with hand motion, and on a still day three or four men can readily open the draw.

The engine and mechanical details were supplied by Joseph Edwards & Co., of New York. The flooring system of the whole structure is heavily timbered and guarded, making it impossible for a derailed engine to endanger the structure. The time occupied in construction was one year from commencement to the passage of trains, although considerable additional time was absorbed in general finishing touches, painting, etc. The following is the schedule of spans, with weight of iron employed in same—all double track, commencing at terminus Metropolitan Elevated Railroad.

	Lineal feet.	Lbs.	
4 lattice spans, each.....	60	234,224	on curve 450 ft. radius.
1 pin connection...	100	166,125	river bridge.
1 "	300	711,758	draw span.
Turn-table, gearing, locking gear, etc.....	....	179,472	
1 pin connection.....	100	166,125	river bridge.
3 lattice, girder spans, each....	60	175,608	on curve 450 ft. radius.
1 skew lattice span.....	89¼	123,823	on curve 450 ft. radius over N. Y. C. & H. R. R. R.
Lineal feet plate girder viaduct..... ...	276⅝	197,321	on curve 450 ft. radius to tangent point on abutment.
Totals..... 1,386		1,954,546	—*Engineering.*

FINELY TEMPERED SWORDS.

The art shown in sword making was not by any means confined to beautiful forms and elaborate ornamentation. The greatest skill was exercised in the manufacturing and tempering of the blade, which, in the days when swords were not only worn but used, was more important than any other part of this weapon. In Europe, the sword manufacturers of Spain first began to have a reputation for producing work of superior quality, and the armorers of Toledo stood foremost among their countrymen. A "Toledo blade" was considered to be a weapon of great value, and, even now, when we wish to speak of something remarkable fine-tempered and sharp, we compare it to one of these swords. The peculiarity of the Toledo blade was not only its extreme hardness, which enabled it to receive and retain the sharpest and most delicate edge, but its elasticity, which allowed it to be bent without being broken. Some of the most famous of these swords could be bent so that the points touched the hilts, and yet they would spring back to a perfectly straight line. It is said that in Toledo sword-blades have been seen in the cutlers' shops coiled in boxes like watch-springs, and although they might remain in this position for some time, they would become perfectly straight when taken out. Other places in Europe were also famous for producing good swords. Many excellent weapons were made in Italy, and Andrea Ferrara, the Italian sword maker, who has been mentioned before, was better known throughout Europe than any other of his craft. To possess a genuine Ferrara blade was considered a great thing by the nobles of France and England.

But it is to the East that the world owes the production of the most finely tempered swords it has ever seen; and the steel of Damascus has been celebrated for many hundred years as superior to any other metal that has ever been made into sword blades. Even the cutlers of Toledo doubtless owed their skill and knowledge to the Moors, who brought from Damascus the art of making blades that were as hard as diamonds, as sharp as razors, and as elastic as whalebone.

Wonderful stories are related of these Damascus swords. We have been told that with one of them a full-grown sheep could be cut in half at a single blow, a heavy iron chain could be severed without turning the delicate edge of the sword, and a gauze veil floating in the air could be cut through by one gentle sweep of the glittering blade. These wonderful scimitars are not manufactured now, but their fame has exceeded that of any other weapon of their kind, and it is quite certain that their extraordinary excellence has not been exaggerated. It is probable that the workers in steel of the present day might be able to discover the peculiar methods by which the Damascus steel was made, but as there would be little use or demand for the blades after they had been produced, it is not likely that their manufacture will be attempted. We should consider, however, that although the present age is preeminent as an inventive and manufacturing period, there are some things which have been produced by the ancients and the artificers of the Middle Ages which we of the present day have not been able to equal. It is possible, therefore, that our steel workers might never be able to make a Damascus blade, even if they wanted to.

Some of the swords of Japan are said to possess wonderful qualities of hardness and sharpness. The story is told that if one of these celebrated blades is held upright in a running stream the leaves floating gently down with the current will cut themselves in two when they reach the keen edge of the sword.

But these Japanese swords, some of which were held in such high esteem that they were worshipped, and temples were built in their honor, were only hard and sharp; they had no elasticity, they could not bend and they might break, and in this respect they were far inferior to the splendid scimitars of the Moors and Saracens. — *From "Swords," by John Lewees, in St. Nicholas for July.*

NOTES.

RELIGHTING SAFETY LAMPS BY ELECTRICITY.

Safety lamps when extinguished by fire-damp must, as a rule, be taken to the surface to be relighted, and the loss of time and the expense which this proceeding entails have caused Messrs Hubert & Durant to propose a method of relighting safety lamps by electricity, and that without opening them or removing them from the air, which may at any moment become explosive. For this purpose the bottom or reservoir of the lamp is provided with two tubes of metals, closed by tightly-fitting wooden plugs. These serve to hold and insulate two copper wires connected by a short platinum wire passing close to the wick. On making contact with a battery, the electric current raises the platinum wire to a white heat and lights the lamp. Various batteries have been tried for this purpose, but as portability, and at the same time high power were required, the bichromate battery was ultimately selected. This consists of a glass cell with wide mouth, containing bichromate of potash and water acidulated with one-tenth its weight of sulphuric acid. Generally one zinc and one carbon pole are immersed in this liquid; but, in order to increase the surface and therefore the intensity, Messrs. Hubert & Durant employ two zinc and four carbon plates. They also propose eventually to supersede the bichromate battery by that of Daniel, reinforced by a Faure accumulator. In order to avoid the sparks which are produced on breaking contact, and which would ignite an explosive mixture, two spiral springs hold the zinc and carbon plates clear of the exciting liquid, so that to make the current pass it is necessary to press the lamp firmly down upon the electrodes. As soon as the lamp is relighted the pressure on the electrodes is released; they rise from the liquid, the current no longer passes, and consequently no sparks are produced on breaking contact. Existing lamps may be modified so as to be lighted by electricity at a trifling cost, which, together with that of the battery, will soon be repaid by the saving of oil resulting from only lighting the lamps when they are required for use, instead of at the mouth of the shaft.

GENERAL INTELLIGENCE.

☞ *We solicit and are always pleased to publish in thes columns any items of interest that may be furnished us.*

GAS AND WATER.

WELLS.—Chief Engineer Spears informed the Long Island City Water Commissioners yesterday that the wells sunk by Tichener & Safford about three months ago are rapidly failing, and unless immediate steps are taken to procure an additional supply there will probably be a water famine during the late summer and fall months.—*World, June 21.*

THE large increase in the consumption of water in Brooklyn has revived the talk of the necessity of enlarging the sources of supply. The well system is being discussed again. During the past ten days the average daily consumption has been 35,000,000 gallons, or about three and a half million gallons more than the corresponding period of last year.

CONSUMPTION AT MILWAUKEE, WIS.—The following is a statement of city water consumed last week:

	Gallons.
Sunday	11,593,938
Monday	15,746,092
Tuesday	15,547,698
Wednesday	14,422,913
Thursday	16,014,583
Friday	14,933,748
Saturday	15,377,419
Total	103,636,391
Average daily	14,805,198
Corresponding week in 1881	14,998,235
Increase	193,037
Coal consumed	79.1 tons.

GAS-WORKS are being erected at Birmingham, Ala. and will soon be in operation.

WATER-WORKS FOR EL PASO.—The material for water-works at El Paso, Texas, has all been shipped and the work commenced. The water will be pumped from the Rio Grande River into a reservoir, placed at an elevation of 100 ft. above the highest part of the city. About 6 miles of 12, 8, 4-in. pipe will be laid. Works to be completed by Sept. 1, 1882. Both of the above works will be erected under the plans and supervision of Sylvester Watts, of St. Louis, Mo., and owned by him and J. W. Parker, of Atchison, Kansas.

RESERVOIR.—Work has been commenced on the great water reservoir at Ripon, Wis., and it is expected that if all goes well a month will see it completed.

WATER SUPPLY OF PEABODY, MASS.—The Fire Department tested the capacity of the water supply Saturday, with a very satisfactory result. Before the trial the pressure at Pickering's store indicated 69 lbs. Six hydrant streams, that threw from 100 to 135 ft., caused the pressure to fluctuate between 63 and 72 lbs. Thirteen streams showed from 62 to 68 lbs. pressure, and 17 streams showed from 57 to 65 lbs. pressure. At the pumping station the pressure was reduced only 3 lbs. The hand engines, that have won high honors at musters, are to be sold.

THE new water-works at Carbondale, Pa., give general satisfaction.

PUMPING ENGINE CONTRACT LET.—The Omaha (Neb.) Water-Works Company have lately contracted with the Knowles Steam Pump Works for two more compound condensing pumping engines, one of which is for pumping into the settling reservoir.

THE NEW WATER TOWER.—The Water Commissioner was engaged yesterday in draughting a diagram of the water tower soon to be erected on Twelfth and Biddle streets. The new tower will be 165 ft. above the surface of the ground, and will be of the same dimensions as the tower on Grand avenue. It will cost $30,000, and will be connected with the engine-houses by four pump mains, which will cost $90,000 each. The old tower has two pump mains, and an additional one is now being constructed. The Commissioner expects to commence work on the new tower within eight months.—*St. Louis Globe-Democrat.*

WATER-WORKS BEING BUILT. — Water-works are being built at Tucson, Arizona. Water will be brought from the Santa Cruz River, 5 miles from the city, through 12-in. mains, and distributed through 7 miles of 12, 6, 4-in. mains. The source of supply is 80 ft. above level of city. No pumps or reservoir will be used. The works will be completed by Sept. 15, 1882.

ELECTRICITY.

THE MEXICAN CABLE COMPLETED. — GALVESTON, June 21.—At 5.30 to-day the final splice of the Mexican cable was made by the steamship International, off Brazos, Santiago, placing Galveston in direct communication with Vera Cruz and telegraphic communication with the whole of South America.

THE TELEGRAPH IN CHINA.—To induce the people to make themselves familiar with the operation and utility of the telegraph, the Chinese authorities have shrewdly made the use of the new lines free for the space of one month.

RIVERS AND HARBORS.

THE ISLAND BREAKWATER.—From the *Toronto Mail*, we clip the following item: "Mr. John Perley, of Ottawa, has prepared plans and specifications for the proposed breakwater for Toronto harbor, and they are now to be seen at the harbor office. The plans call for a line of cribbing 6,630 ft. in length, extending in a curve from near Gooderham's wharf to the southern extremity of Fisherman's island. Between the latter and the main island the cribbing will extend a distance of 2,330 ft., where a gap 500 ft. in breadth will be left. From the eastern end of the main island the cribbing will be continued westward along the lake side for 6,550 ft., making in all 15,460 ft., or nearly three miles.

STREETS, DRAINAGE, ETC.

THE SEWERAGE QUESTION.—A dispatch from Brockton, Mass., says: A petition is now being circulated among the residents of this city in relation to the immediate construction of public sewers, and has received the signatures of some of the heaviest tax-payers in Brockton. The petition will in due time be presented for the consideration of the Municipal Government.

RAILROADS.

NEW LOCOMOTIVE WORKS.—It is claimed that $500,000 have been subscribed for the purpose of establishing a locomotive works at a point just west of the city limits of Chicago, and that contracts have been let for the erection of buildings to cost $102,000, to comprise machine shops 453 by 88 ft. and two stories high; a foundry, 200 by 82; a boiler shop, 200 by 82; blacksmith shop, 200 by 52; a tender, truck and paint shop, and a pattern shop. The establishment, which will be called the Chicago Locomotive Works, will, it is said, be under the superintendence of Franklin D. Childs, now superintendent of the Hinkley Locomotive Works, at Boston. This project, which was announced a good while ago, has seemed to have the flavor of a real estate speculation, but it may be that the locomotive works feature will be carried out. More definite information, however, is desirable.

SAN PETE VALLEY (N. G.).—This road was built in 1881 from Nephi, on the Utah Southern, southeasterly to Wales, Utah, 30 miles. It has been decided to build an extension from Nephi north about 40 miles to Springville, on the Salt Lake extension of the Denver & Rio Grande, and another from Wales south to Manti, 20 miles.

EXTENSION.—The Milwaukee, Lake Shore & Western line has been opened to Pelican, Wis. Eleven hundred men are pushing the road beyond Pelican,

CONSTRUCTION WORK.—Reports from Milwaukee state the grade on the Chippewa Valley & Superior road, as well as the bridge work, were completed Thursday. The track is now within five miles of Reed's Landing, the western terminus. The branch from Durand to Cedar Falls, a distance of twenty-two miles, is well along, and the contractors expect to complete the grading work by the 10th of July. The contractors, Wells, Harrison & Green, who also have charge of the construction work on the Toledo & Northwestern branch of the Chicago & Northwestern road, projected to run from Eagle Grove to Alton, on the Chicago, St. Paul, Minneapolis & Omaha line, state that the grade will be finished Aug. 1. The track laying has progressed as far west as Peterson, 83 miles west of Eagle Grove. They also state that 400 men and 200 teams are at work between Schleisingerville and Neenah. This force is being augmented as rapidly as the right of way is being secured. Condemnation proceedings have been begun in many cases.

WATER-WORKS COMPLETED.—ATLANTIC CITY, N. J., June 18.—The Atlantic City Water-Works Company made their connections at 7 o'clock this evening. During the evening water was distributed through their pipes on all the avenues in the city.

STEEL RAILS.—Four thousand tons of steel rails are discharging at College Point, sixty miles above New Orleans for the New Orleans & Mississippi Valley Railroad, recently bought by R.T. Wilson & Co., of New York. The engineer corps are pushing forward in the direction of Baton Rouge, through the sugar plantations on the banks of the Mississippi, and tracklaying will soon begin.

TRACKLAYING has commenced on the Nebraska, Topeka, Iola & Memphis Railroad at Girard, Kan. The road will be completed to Walnut by July 4. Coal has been reached in the Prospect shaft, one mile east of this place, at a depth of sixty-five feet.

NEW ROAD.—Certificate of incorporation was filed at Albany on the 19th by the Addison & Northern Pennsylvania Railway. The company is to continue in existence one hundred years. The road is run from the New York, Lake Erie & Western Railroad at Addison, Steuben County, to a point on the State line between New York and Pennsylvania, on the southerly boundary of Steuben County. The length of the road will be twelve miles. The capital is $600,000.

CANADIAN PACIFIC.—The last rail of the Canadian Pacific Railroad, between Prince Arthur's Landing and Winnipeg, Man., was laid last Saturday, and the eastern territory now has communication with the Prairie province practically independent of United States railroads.

SOUTHERN ROAD INCORPORATED.—On the 19th articles of incorporation were filed in the Secretary of State's office, Little Rock, Ark., of the Springfield & Southern Railroad Company of Arkansas; capital stock, $3,500,000. The proposed railroad begins at a point on the northern boundary of Arkansas below the line of Taney County, Mo., and runs in a southwestwardly direction to Little Rock.

OVER 1,000 MILES EACH.—There are in the United States 16 different railroads, each of which controls and operates over 1,000 miles of track.

ONTARIO & QUEBEC.—Some 200 men are now employed on the Ontario & Quebec Railway between Perth and Moberly, while excellent progress is being made on the Midland between Perth and Sharbott Lake.

THE LAC VIEUX DESERT Railway Company was organized under the laws of Michigan, and its projected line runs northwest from Menominee to Lake Agogebic, where it touches the Milwaukee, Lake Shore & Western's projected road. During the past year the surveyors have been busily engaged in locating this new line, but no construction work will probably be done before the middle of the season of 1883.

A PENNSYLVANIA ROAD.—The building of the new Shamokin, Sunbury & Lewisburg Railroad is being pushed forward with great energy. There are now upwards of 1,000 laborers engaged in the work.

LOCOMOTIVE TRADE.—The Baldwin Locomotive Works have orders enough on hand to keep their three thousand men employed the whole year. The firm is constructing locomotives at the rate of 600 a year. Of those now being built, 50 are for the Philadelphia & Reading and 60 for the Pennsylvania Railroad.

BRANCH ROAD PROJECTED.—SPRINGFIELD, Mo., June 15.—Close upon the heels of the announcement that the St. Louis & San Francisco Railway Company will on to-morrow commence work on a branch road from Springfield to a point on the Mississippi in the southern part of Arkansas, comes a well-authenticated report that the same company are considering a project to build a railroad from here northward through Bolivar and Warsaw, and connect with the Chicago & Alton at Marshall, Saline County, Mo. Meanwhile there is no abatement of the building and immigration boom here, and the rapidity with which Springfield is becoming a city of commercial importance is phenomenal.

NEW RAILROAD IN VIRGINIA.—The Shenandoah Valley Railroad, extending from Roanoke, Va., to Hagerstown, Md., has been completed and opened for travel. The road forms a direct line between Northern cities and South and West. The length is 240 miles.

WORK ON THE FT. W., C. & L. RAILROAD.—The Ft. Wayne, Cincinnati & Louisville Railroad Company are making decided improvements in their road-bed this summer. New bridges, culverts, etc., also steel rails, are being put down, and work generally to put the road in first-class condition is being done now.

THE ST. LOUIS & WESTERN RAILWAY.—The old Laclede & Fort Scott Railroad, running from Lebanon, Laclede County, due west across the State to Fort Scott, Kan., has within the past year changed hands and names. It still, however, under the name of the St. Louis & Western Railway, retains all the desirable features of a most remarkable charter granted in 1867, prior to the new Constitution, allowing of the extension, at will, of branches through any of the counties of the State. The new directors have taken advantage of this provision and have projected branches from Bolivar, on the main line, to Kansas City, passing through Clinton; a continuation of the branch from Clinton passes through Tuscumbia, where it is joined by another branch from Bolivar, and goes thence to St. Louis. From Bolivar there is also a branch to extend through Lamar to Carthage, thus giving a more direct line to the Southwest portion of the State than even that of 'Frisco. The 'Frisco line passes through Lebanon and Springfield, at the first making a junction with the main road, and at the second with another branch from Bolivar. A branch is also projected from Lebanon to a point opposite Chester, Ill., where it can make connections with the great trunk lines south from Chicago. The arrangement of the system is such as to give the company a road from Kansas City to St. Louis and from either of those points to the southwestern part of the State, going via Bolivar. Upwards of ten years ago between $300,000 and $400,000 was expended upon the road building from Lebanon west, and also a short strip of 17 miles from Nevada City toward Ft. Scott. The road being in the hands of a receiver after the panic, the Missouri, Kansas and Texas squatted upon this 17 miles of road-bed and has been using it ever since. On June 19 the stockholders met in Nevada City and placed the first mortgage upon the charter. This was for the sum of $12,000,000, which it is computed will be sufficient to build the 600 miles of road which is to compose the system. The bonds are to be issued only as the road is built and according to the mileage, the amount being arbitrary. Of the old county bonds subscribed by the counties, Laclede County issued $110,000, Dallas County $250,000, Polk County subscribed $250,000 and issued $33,500. These various sums were expended on the road. Laclede County has paid the interest on the bonds; Polk County has done the same, but Dallas County fell flat from the first. Vernon County and the city of Ft. Scott paid for the grading of the 17 miles now occupied by the M., K. & T. Railroad. Work will be pushed on the main line immediately, both from the east and west end. This completed, the branches which promise the most will be constructed. Ties and rails are being received at Lebanon now, and it is expected that the main line will be completed during the present year. The stockholders, while at Nevada City, elected the following directors and officers: J. N. B. Dodson and W. W. Prewitt, of Nevada City; B. F. Helper, of Ft. Scott; J. W. Farmer and C. E. Bushnell, of Bolivar; George W. O'Bannon, of Buffalo, Mo.; W. R. Hall and H. Ottaway, of Lebanon; Ozias Bailey, of St. Louis; Z. E. Elkin, D. M. Yeomans, William P. Watson and John C. Short, of New York City, directors; and J. N. B. Dodson, President; D. M. Yeomans, Vice-President; H. Attaway, Secretary, and William P. Watson, Treasurer.

CONNOTTON VALLEY.—It is reported that the contracts for completing the Connotton Valley Railroad have been placed upon extremely favorable terms. The steel rails are contracted for at $51 per gross ton, and are being delivered on the ground. Laying of track commenced on the 15th inst., and it is expected that trains will run into Coshocton by Oct. 1, and to Zanesville before the close of the year. It is under consideration to put on a tug and two barges to connect the business at the company's dock at Cleveland with the lower harbor, which will be probably done by gentlemen outside the company, but interested in its progress. This project has been carefully considered, and it is the judgment of all that it will add very largely to the business of the company. The excursion business alone along the line will add for the season an average of $800 per day to the net earnings. A considerable saving will be effected on all the estimates in the plan of reorganization, and with careful economy it is claimed that the road can be put on a firm interest-paying basis, as it is indisputable that no road in Ohio is more favorably situated and with better terminal points.—*Boston Journal.*

CANALS.

ROME, Ga., has completed the survey of her proposed canal, and estimates the cost at $25,000 per mile.

THE PANAMA CANAL.—A Washington dispatch to the *Boston Journal* says: Mr. Thompson, ex-Secretary of the Navy, who is the American representative of De Lesseps's Panama Canal scheme, is now here. He reports the progress of the canal as very flattering, that the difficulties relative to parts of the survey have been removed, that rock is being rapidly blasted, and that within a few days a contract has been let to an American company to excavate 7,000,000 cubic feet. Materials are all on the ground, and houses are provided for the workmen. He has less confidence in the Nicaragua plan than ever, and says that that company lacks and is likely to always lack what the Panama company has already secured, a charter and an abundance of money.

GEORGIA CANALS.—About one mile of the canal through Cuyler's Swamp, near Savannah, Ga., has been finished.

CONTRACTS LET.

BOSTON, MASS.—The contracts for the People's Church, at the cor. Columbus ave. and Berkely st. have just been awarded to S. M. Chesley & Co., carpenters, and Sampson, Clark & Co., masons; cost, $150,000.

CINCINNATI, O.—Messrs. Jones Bros. & Co. have let contracts for building a five-story printing house, 48'x60'; cost, $20,000; Mr. Chas. Crapsey, architect.

Bids have been received by the Supervising Architect for the court-yard, roof and ceiling of the Customhouse as follows: Snead & Co., iron works, $51,389; Haught, Peckham & Co., $57,308; Henvel, Man & Co., $82,538; and Mr. Clements, three bids, the lowest, $84,565.

ST. JOHN, N. B.—The Albany (N. Y.) Architectural Iron Works have received the contract for all of the iron-work to be used in the construction of five large buildings to be erected here.

HARTFORD, CONN.—The county commissioners have decided to call for no bids for erecting the new county building, but the work will be done by Messrs. John R. Hills and John C. Mead, under the direct supervision of the commissioners, all purchases and expenditures to be made by them.

GOVERNMENT CONTRACTS LET.—Bids were opened June 20, in the War Department, for furnishing a hydraulic ash-lift or elevator for the north wing of the State, War and Navy Department building. The bidders were: Eli Thayer, Philadelphia, $1,300; Ferrill & Mickle, Philadelphia, $1,235.50; Stokes & Parish, Philadelphia, $1,275; George C. Howard, Philadelphia, $700; Snowden & Cowman, Baltimore, $1,262; Otis Bros. & Co., New York, $1,100; Granville Hydraulic Elevator Co., N. Y., $1,875, and Whittier Machine Co., Boston, $1,063.

LEVEE CONTRACT LET.—Contracts for the Lewiston levee, in Columbia County, Wis., have been let to local bidders at 13 $\frac{9}{10}$ cents per yard, including sodding.

BUILDING CONTRACT LET.—The contract for the erection an extension to the capitol at Madison, Wis., has been awarded to Janesville parties for $188,370.

BUILDINGS.

NEW CHURCH.—Danville, Ill., is to have a $20,000 church.

THE NEW HOTEL building at Peoria, Ill., will cost $130,000.

PLAN FOR CHURCH ACCEPTED.—A dispatch from Holyoke, Mass., says: The building committee of the Second Congregational Church have finally decided to accept the plans of Architect Kilburn, of New York, and a contract has been forwarded to him. The expense of the building is not fully known.

SOME thirty buildings are now going up in Pensacola, Fla., to cost $300,000.

FOSTORIA, O., is to have a railway spike factory, to emp loy two hundred men.

GALVESTON, TEXAS, wants a grain elevator.

WATERTOWN, MASS., will erect a public library building, to cost not more than $30,000.

SCHOOL-HOUSES.—Lexington, Ill., has determined to build two brick school-houses this summer, one costing $3,000 and one $2,000.

TOLEDO, O.—There has been nothing flattering to chronicle regarding building matters in Toledo nor its vicinity, so far as '82 can yet show.

The bulk of work has been a very cheap class of cottages and a few "pasteboard" store buildings. Yet carpenters are not plenty: certainly *skilled* workmen never seemed more scarce. But of botches, or, more properly, poor, ignorant men who never learned a trade, and who are never surprised at being "shipped" at any hour in the day, and whose "kit" is a dull hatchet and a bent square, there are a plenty; indeed a surfeit. Pitiable indeed the position of the poor architect who so far forgets himself as to consent to superintend a piece of work for an owner so deluded as to believe that the buildings will be produced to him "according to plans and specifications," or that such a thing is possible under the present régime.

Building material is rather high still, and will probably so rule. Some have concluded to defer building till there's a decline, which can't come unless it is wished to repeat the horrors of '78 to '80. The fact is, the prices now are healthy, where before they were far the other way. All will come right in time.—*American Architect.*

LABOR.

WAGES OF BRICKMAKERS IN CHICAGO.—About 3,500 brickmakers who recently obtained an advance of 12½ cents a day have notified their employers that they will demand a further increase of 12½ cents.

BRIDGES.

THE Georgia Railroad bridge at Athens will be the highest in the State.

DRAWBRIDGE OVER THE PASSAIC RIVER.—This bridge was built by the authorities of Hudson and Essex counties, New Jersey, over the Passaic River on the line of the turnpike between Jersey City and Newark. The draw is 180 ft., with two spans of 170 ft. each. The bridge is of iron and was built by the Wallis Iron Works, of Jersey City, N. J.

A BRIDGE RUMOR.—ST. LOUIS, June 18.—It is stated, on what is deemed good authority, that the visit here last week of President Roberts and other officials of the Pennsylvania Railroad was in part, at least, connected with a new scheme of no less magnitude than the building of another bridge accross the Mississippi River at this point. It is said while these officials were here they were in close consultation with the officials of the other roads, and that the bridge project was freely discussed. The scheme embraces the Pennsylvania company, the Baltimore & Ohio, the Chicago & Alton, and the Indianapolis & St. Louis, and the project is to build a bridge a little north of the city at a point known as the Chain of Rocks, where a good foundation for piers can be obtained at very moderate expense. The proposition has been talked of before, but it is said to have taken a more definite shape this time than on any previous occasion.

BRIDGING THE RIDEAU RIVER.—The bridges of the Canada Atlantic Railroad over the Rideau River and Rideau Canal are about ready for the iron superstructure, and work will be commenced next week by the Toronto Bridge Company, who have a contract for this part of the work.

BRIDGES SWEPT AWAY.—CINCINNATI, O., June 15.—The storm last night prostrated four bridges on the Cincinnati, Indianapolis, Chicago & St. Louis Railway, between Guilford and Indianapolis. The Little Miami Railway track has been under water for a short time at various points, but no detention of trains is reported. The Ohio & Mississippi Railway is running to St. Louis on schedule time. The telegraph wires on the Big Four between here and Indianapolis, are down.